SCIENTIFIC AMERICAN

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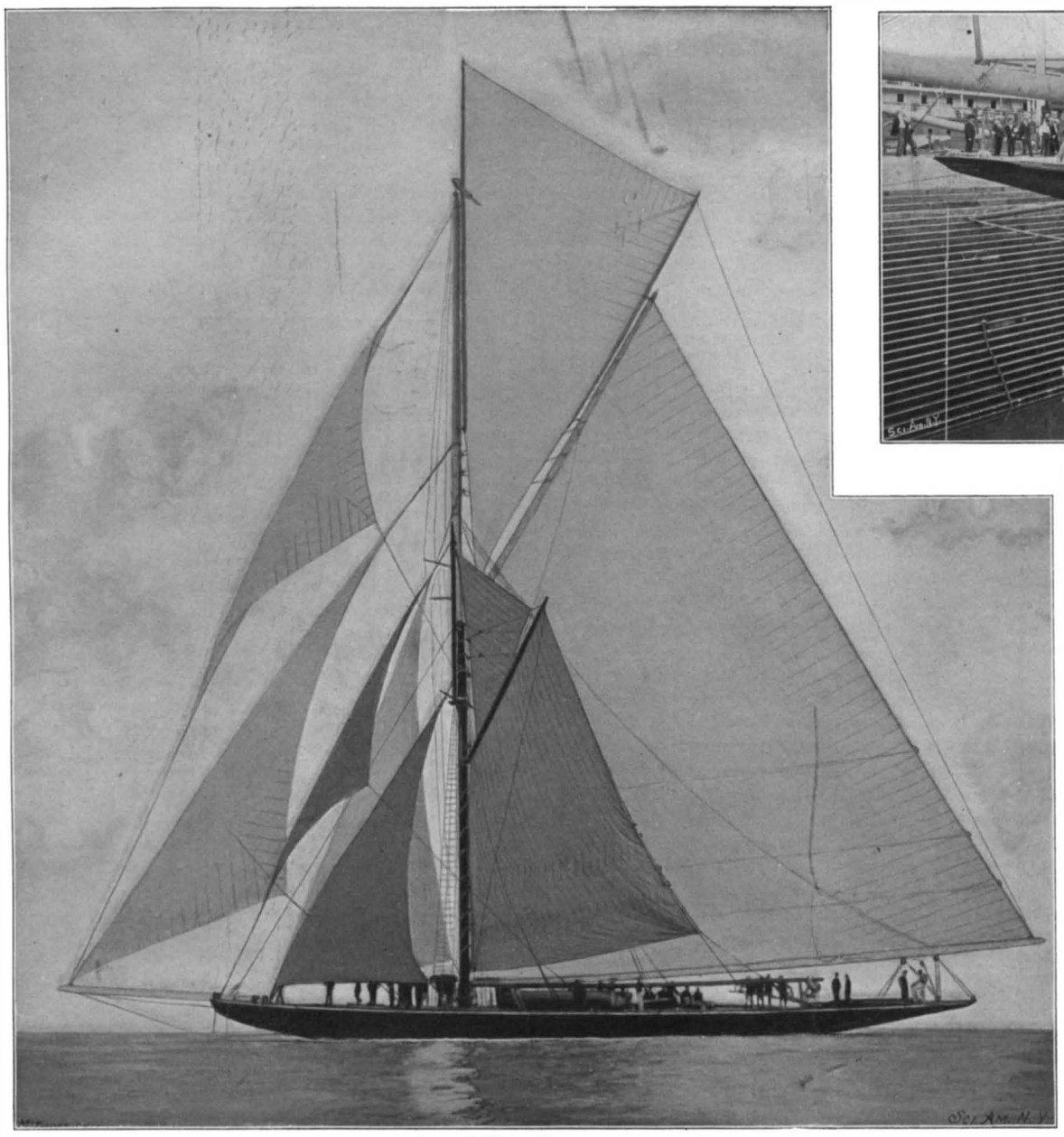
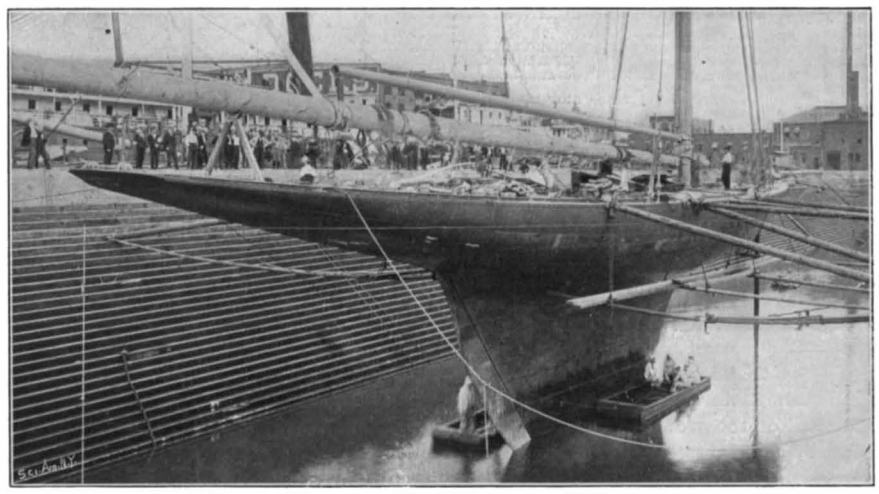
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

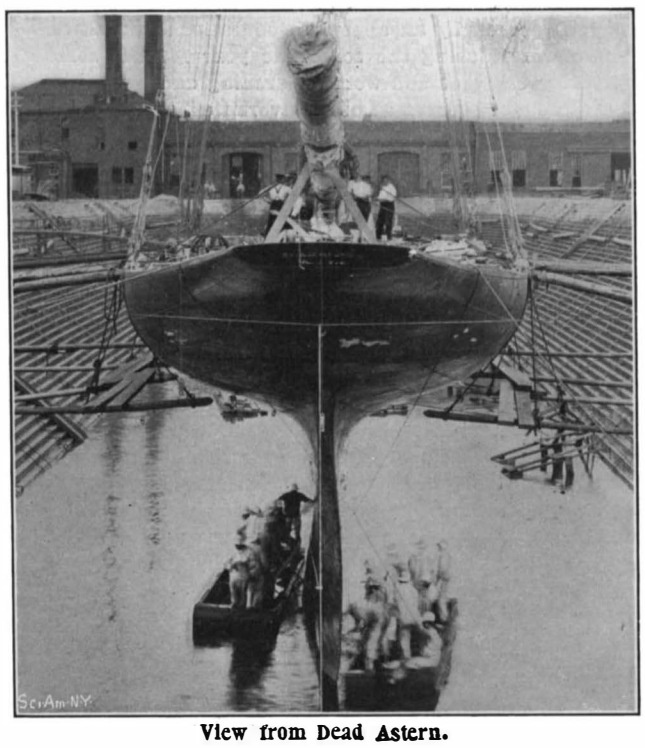
Vol. LXXXV.—No. 8. ESTABLISHED 1845. NEW YORK, AUGUST 24, 1901. $3.00 A YEAR. 8 CENTS A COPY.



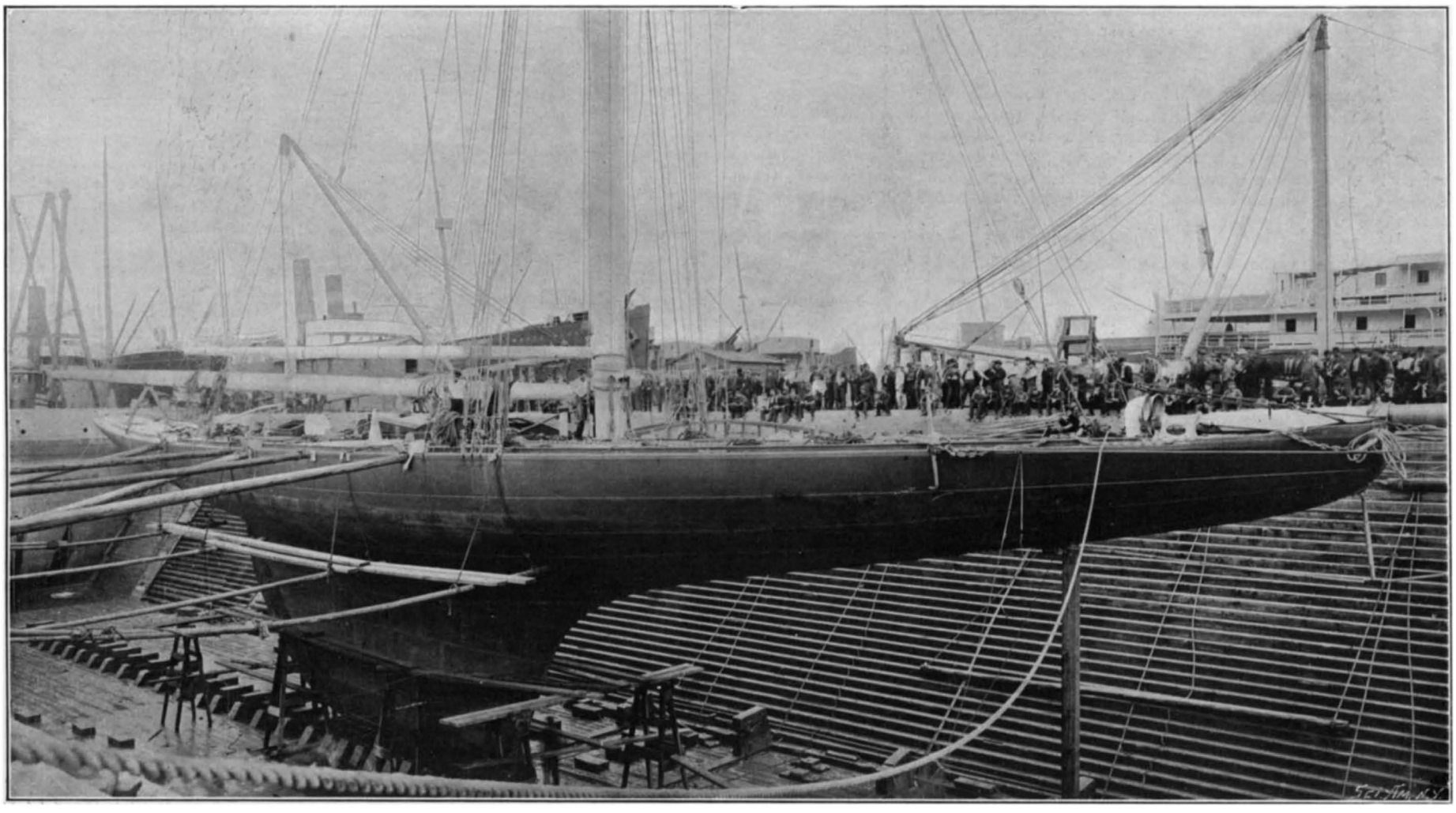
"Shamrock II." in Ocean and Racing Rigs.



View from Off Starboard Quarter.



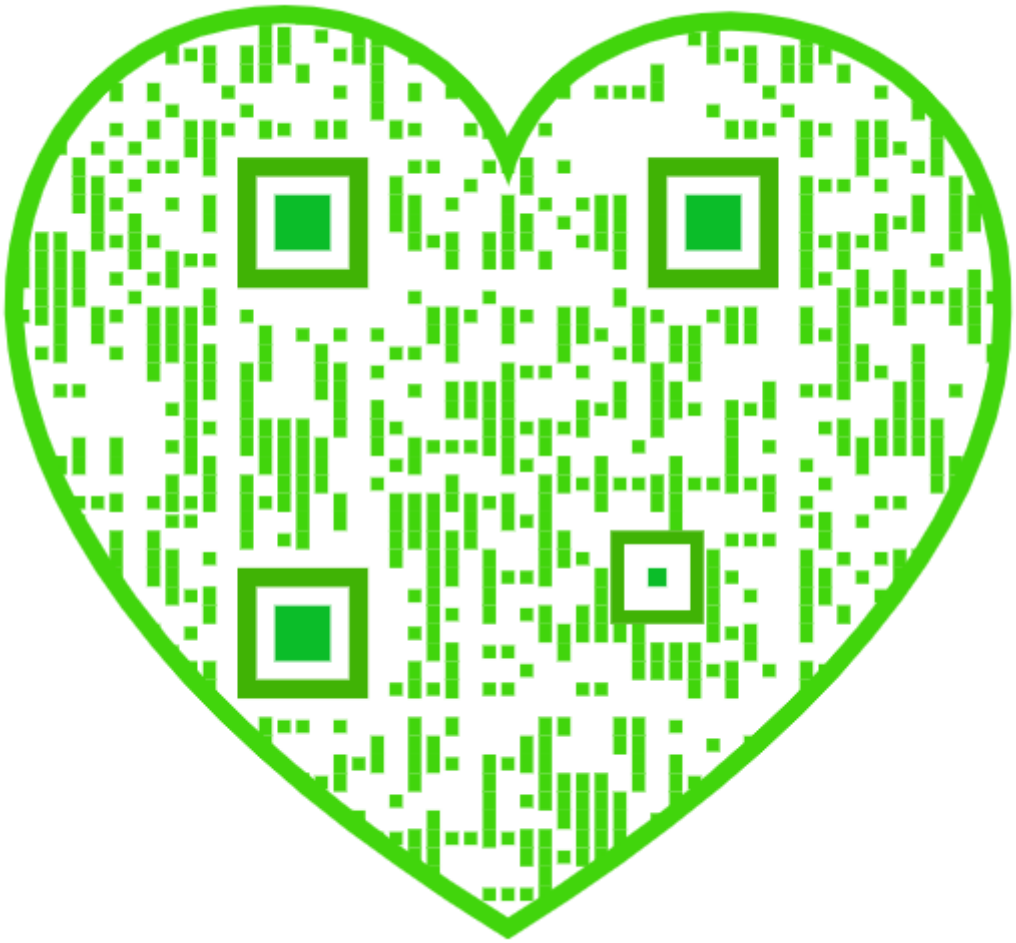
View from Dead Astern.



View from Off Starboard Bow.

THE ELEVENTH CHALLENGER FOR THE AMERICA CUP—"SHAMROCK II."—[See page 122.]

Length over all, 137 feet; beam, 24 feet; draught, 21 feet 3 inches; pole-mast, deck to truck, 150 feet; boom, 102 feet 9 inches; gaff, 66 feet; sail area, 14,500 square feet.



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States. Canada. or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, AUGUST 24, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

TRADE AND HIGHER EDUCATION.

In this latter-day eagerness for supremacy in the markets of the world, it is often charged that, in this country at least, education and the intellectual pursuits which go to make up the higher culture are sacrificed to purely utilitarian considerations—in other words, seeking after gain. That this is not the case may be proved by an appeal to educational statistics. There were, during the scholastic year 1898-99, some 147,164 young men and women pursuing undergraduate and graduate courses at our universities, colleges and schools of technology. Of this number only 43,913 were enrolled as professional students in law, medicine and theology, leaving 103,251 pursuing studies in the liberal arts and applied sciences. In 1880 the number of students was 119,340, and in 1890 118,581, so that the educational advantages and the number of those who embrace them is on the increase, being in direct ratio to the upward trend in our national wealth.

To provide proper educational facilities was one of the first matters which engaged the attention of the founders of our country. Each of the colonies established in the seventeenth century took measures, more or less effective, to provide schools for the children. The Dutch West Indies Company in 1621 charged its colonies to maintain a clergyman and a schoolmaster. There were private schools in the Virginia colony at an early date, and most of the wealthy planters employed tutors in their families. The Governor of the Connecticut colony reported that one-fourth of the annual revenue of his colony was expended in maintaining free schools for the education of the children. Boston had schools as early as 1635, and they were also established in Rhode Island in 1650. With the growth of cities there began the improvement of the schools, the separation of the children into grades, educating primary children of the first year in one class, and those of the second year in another class. Facilities for higher education were not wanting. Harvard was founded in 1636; William and Mary College in 1660; Yale in 1701; Princeton University, then known as the College of New Jersey, in 1746; the University of Pennsylvania in 1751; Columbia University in 1754; Brown University in 1764; Dartmouth College in 1769. Others followed, so that by the year 1800 there were 24 colleges in the United States—8 of them in the New England States, 6 in the Middle States, and 10 in the Southern States. The early legislators, Washington, Madison and John Adams, all used their influence to forward the cause of education, and particularly of higher education. The government assists institutions in various ways, although the actual amount of money which is appropriated is small and most of it goes to agricultural colleges. Still, however, it has made large grants of land from time to time, aggregating in all 13,000,000 acres. A new seat of learning, to be called the Washington Memorial Institution, has recently been organized, both as a memorial to George Washington and to increase, in the Capital of the country, opportunities for higher education as recommended by our first President in his various annual messages to Congress, and to facilitate the utilization of the scientific and other resources of the government for the purposes of research and higher education.

To-day there are 629 universities and colleges and 43 schools of technology in the United States. The total value of the property possessed by institutions for higher education amounts to $342,888,361, a gain of about $31,000,000 over the amount for the preceding year, 1897-1898. The endowment fund amounts to $154,120,590, and the remainder represents the value of grounds, buildings, machinery, apparatus, libraries, etc., used for instruction and research. The total income for the year, excluding benefactions, amounted to $27,739,154 derived from the following sources: Tuition and other fees, $10,924,415; endowment funds, $6,673,389; state and municipal appropriations, $4,287,102; the United States Government, $3,276,731, and from other sources, $2,577,517. The value of gifts and bequests during the year 1898-1899 amounted to $21,925,436. The amounts reported by some of the institutions are as follows: University of California, $757,000; Leland Stanford Junior, University, $11,000,000; University of Chicago, $786,624; Harvard University, $1,544,330; Columbia University, $518,667; University of Pennsylvania, $510,658; Armour Institute of Technology, $750,000.

From these figures it will be seen that our plant for educational purposes is of enormous value and its efficiency is all that could be asked for. In reality some $2,500 is invested for each student who is now enjoying the advantages of any of the institutions of learning, and the work of the graduates of the last two generations shows that our money has been put out at compound interest.

It must not be supposed that all the students, however, are devoting their energies to the very serious problem of fitting themselves for their life work. On the contrary, the majority are pursuing courses which will not materially assist them to earn a living, but which have, of course, an important bearing as regards culture on their future lives. Classical courses claim by far the greater number of students: 35,595 students out of the 147,164 were pursuing such courses, while 21,860 were taking the general culture courses, 9,858 took general science courses, 2,593 received instruction in agriculture, 4,376 were taking courses in mechanical engineering, 2,550 in civil engineering, and 2,320 in electrical engineering; 1,032 students were studying mining engineering, 627 architecture, 9,501 pedagogy, and 6,698 were taking business courses.

Approximately the same figures hold when degrees are considered. Thus the number of degrees conferred during the year for work done was 15,087—10,794 being conferred on men and 4,293 on women, as follows: The degree of Bachelor of Arts leads, with 4,910 men and 1,950 women; then came Bachelor of Science, with 2,410 men and 500 women. The Master of Arts degree came next, with 1,046 men and 197 women. The degree of Doctor of Philosophy was conferred on 299 men and 26 women. Thirty-eight different varieties of degrees were conferred, and in some cases only one candidate received a degree, Musical Doctor, for example. Seven hundred and thirty-five honorary degrees were conferred.

The ratio of students to population is an interesting study. In 1872 the number of students to each 1,000,000 persons was 573; in 1880 it had increased to 770, in 1890 to 850, in 1893 it had increased to 1,037, while in 1899 the number was 1,196. These figures show that the increased prosperity of the country has a very direct effect upon education. When the splendid gifts which have been made to the cause of education in the last ten years are considered, it may safely be said that the desire for gain does not blind our wealthy men to the advantages which accrue to the country by reason of superior educational institutions.

"SHAMROCK II" AND "COLUMBIA" COMPARED.

For the first time in the history of the America Cup races it has been possible to get a line upon the two boats which will meet off Sandy Hook; for we take it for granted that unless "Constitution" can be brought to the point in which she can beat "Columbia" in a wind of more than 7 knots' strength, the older boat will be called upon for the second time to represent this country in the famous contest. In 1899 "Columbia" met "Shamrock I." nearly a dozen times off Sandy Hook, and during the present season "Shamrock II." has been tested against the old challenger in numberless trials under all possible sailing conditions.

In the present uncertainty as to "Constitution's" full capabilities, we must take "Columbia" as a basis of comparison. In 1899 she beat "Shamrock I." by 10 minutes in an average 8-knot breeze, and again beat her by 6 minutes 16 seconds in a breeze of about 20 knots an hour. Both of these races consisted of windward and leeward work with no reaching. It is generally admitted, both here and in England, that "Shamrock I." suffered somewhat from poor handling, and much more from the fact that her spars and standing rigging were too frail, and failed to keep the sails up to the wind. The only changes, we are now informed, made in "Shamrock I." preparatory to her trials with "Shamrock II." were to reduce her sail-plan and greatly strengthen and stiffen her spars, with the result that her sails set admirably and she no longer carried a lee helm. As the result of the improved set of her sails, her better helm, and the fine weatherly qualities she developed, the experts who have had charge of her trials have assured the writer that she is at least 5 minutes faster over a 30-mile course, the gain being chiefly in windward work. To this may be added a possible gain in speed due to the better handling which she received under her new captain.

In the later trials of "Shamrock II.," when her best trim had been determined, she beat the older boat by the following carefully-timed amounts in good wholesail breezes: Going to windward she gained 3 minutes in 13½ miles, the boats having split tacks to avoid interference; going to leeward in a 17-knot breeze she gained 4½ minutes in 13½ miles, "Shamrock II." being the leading boat; while on a broad reach in a 13-knot breeze, with the wind slightly abaft the beam, she gained 4¼ minutes in 7 miles. This last is certainly a remarkable performance in view of the fact that "Shamrock I.," in a tuning-up trial down the Jersey coast and back, reached for 30 knots at a speed of 13 knots an hour. These results would indicate that "Shamrock II." is about 12 minutes faster in a club-topsail breeze than "Shamrock I." in the form that the latter showed when over here in 1899.

It is reasonable to assume that another season's experience on the part of the very able skipper of "Columbia" and his crew have enabled them to get a few minutes more speed out of "Columbia;" in which case we may look for a contest, should "Columbia" be chosen, which will be worth going far to see. The question of the absolute security of the Cup is dependent just now, evidently, upon what further speed can be developed in "Constitution."

DANGER TO ST. PAUL'S CATHEDRAL.

It is seldom that modern building operations and engineering works injure a great edifice; so the news that St. Paul's Cathedral, in London, is in danger comes as a painful surprise, for it is one of the most celebrated buildings in the entire world. The report of the architect to the Dean and Chapter states that St. Paul's is cracked from top to bottom, and while the present damage can be readily repaired it shows a condition of affairs which is really alarming. Sir Christopher Wren built the cathedral after the great fire of 1666, when the older Gothic building was destroyed. Unfortunately for his fame as an engineer he failed to drive piles or to excavate deep enough to place its foundation on a firm sub-soil, so that he practically floated the cathedral on a layer of fine clay, or "pot-earth," as he was pleased to call it, resting on a strata of sand mixed with gravel and water; but he knew of the existence of a bed of hard clay some 40 feet below the surface, but did not carry his foundation so far down, owing probably to the smallness of the available funds. It would have been wise, however, to have built a slightly smaller building on a more suitable foundation. The cathedral, with its great dome, has successfully stood for centuries without perceptible damage, and if it were not for the great excavations which have recently been made in its vicinity it would probably remain in its pristine state. Sewer after sewer has been built, causing the foundation to settle. The old underground railway tunnel was some 500 feet away, and this also had its effect, but it is a later tunnel which has caused the present perceptible and alarming damage.

A number of borings have been made for a new underground line on the south side of the cathedral. It is to be hoped that means will be found to alter the course of this line, so that the noble example of Sir Christopher Wren's work may remain intact.

MODERN STRUCTURAL STEEL.

It is the popular idea that steel is a hard, polished metal like a dagger or a razor, and capable of carrying a cutting edge, but there are steels of various kinds that do not possess the qualities mentioned. Structural steel, for example, such as beams, girders and rough-rolled bars, generally has a much higher tensile strength, elasticity and tenacity than iron, and yet, in physical constitution and external appearance, it differs but slightly from it. Of two bars, one iron and the other steel, put through the same rolls at the same heat, not even an expert could distinguished one from the other if they were laid side by side. Moreover, careful analysis fails to discover the line of actual departure between steel and iron in the lower grades of each metal, or where the metal commences to be steel, so to speak, and stops being iron.

But as between the two metals, iron and steel, there is a vast difference in their endurance and ability to stand severe work, and modern engineers have a very great advantage over their predecessors of half a century ago in the possession of it. In modern open-hearth and other process-steels the amount of fatigue or continuous resistance to crucial strains of long duration which they will endure is simply astonishing—not laboratory, or test-machine strains, but the downright pounding and flogging of daily work, which is far more serious than any testing machine can deliver. This last sets up a certain stress in a straight line, gradually increasing up to failure under it; but the duty imposed upon steel by daily work in a high-speed engine, for example, is not only to resist tensile strains, but torsional and transverse burdens at one and the same time.

Consider the case of a 30,000 horse power marine

engine worked under 200 pounds boiler pressure, and making nearly, if not quite, 1,000 feet of piston speed per minute; each one of the details under strain is twisted, pushed, pulled and pounded, as one may say, in all directions at each revolution, possibly 100 times a minute. Does it not require a metal of faultless integrity to hold on, not for one voyage, but for year after year with very few failures? Locomotives making high speed with heavy loads are subjected to still heavier tests of the strength of details, for not only are they driven faster, but they have to sustain shocks and jars which are absent in marine engines; but instances of failure, compared to the number of engines in use, are few.

The physical qualities demanded for steel used in marine boilers by the United States Treasury rules would seem to be very exacting, inasmuch as they require a tensile strength of 60,000 pounds per square inch in the best, an elongation of 25 per cent in two inches for plates of quarter-inch thickness, and that the metal be capable of being bent on itself (doubled over) so that the inner radius of the bend shall be only one and one-half times the thickness of the plate, which must be heated to a low cherry red and quenched in water of 82 degs. F. As a matter of fact American boiler plate will stand much severer tests than this; plates half an inch and even thicker can be bent down flat cold so that the parts touch each other, without showing the least "craze" or fatigue on the inner or outer parts of the bend; withal, they will stand a very high heat for flanging purposes or dishing. We have seen plates flogged in a former by mauls, dished out like the crown of a derby hat, and reduced in thickness from three-eighths of an inch to three-sixteenths of an inch at the finishing edges—over a diameter of four feet—without a flaw in the whole plate. This was stock ordered from the mill, taken as it ran, and by no means a special steel.

Wholly aside from the benefits constructing engineers derive from having such material is the security that engineers in charge of ships feel when running at high speeds. When iron was used this feeling did not exist, for there was never any certainty that there were not internal flaws that would give away suddenly under severe duty; but modern steel is so homogeneous in its structure that the percentage of failure from the cause named is very low.

AMERICAN ADULTERATED FABRICS AND TESTS.

American looms and dye pits turn out to-day about every variety of fabric for modern need and luxury, and with the rapidly expanding textile industries in cotton, wool, silk, linen, and worsted goods, the time seems approaching when we will be nearly able to supply the world with these products. It was not so many years ago that American looms were comparatively few and unimportant, especially for the more expensive grades of goods, and most of the expensive weaves were imported. But through the introduction of improved machinery and the invention of new methods of weaving and dyeing, we have become within a few decades one of the leading textile manufacturing countries of the world.

Positive genius of a high order has been expended in inventing methods of weaving shoddy and adulterated goods in this country. This has not been with the idea of deceiving or defrauding any one, but simply to meet a legitimate demand. But there should be understood more generally a clear knowledge of the difference between the genuine and adulterated textile goods. If this were thoroughly comprehended, there would be less attempt to deceive, and the purchaser would know what he was paying for. The machinery invented to manufacture these so-called shoddy goods usually adulterate them in the warp yarn and not in the weft. The two-ply yarns are formed by twisting a wool and cotton or silk and cotton yarn together, and if the warp is examined and the yarns untwisted the cotton can be detected. Cotton being the cheapest fiber we have, it is used most extensively in all the adulterated goods. Cotton is cheaper, and also less durable. If the yarns of the warp are removed, and they are tested by fire, it is easy to determine if there is much cotton in the material. In some goods part cotton is better than the pure wool or silk; but in fabrics where it should not be its presence can be detected by burning two or three of the warp yarns. The cotton yarns will flash up quickly and burn rapidly without much odor, but the wool yarns will emit a burnt-hair odor and burn slowly. So sure is this test that it is impossible for any intelligent person to be deceived.

Some of the weaves are so ingeniously put together that it is difficult even for expert buyers and manufacturers to detect the cotton absolutely without some kind of test. The goods are finished off so that they appear as good as the genuine. Expert buyers sometimes test the goods with acids. A sample an inch square of the fabric is taken for the test. This is laid in a porcelain dish, and a 50 per cent solution of sulphuric acid is poured over it. The dish is held over a slow fire for a short time until the cloth begins to undergo a slight change in color. Then, when the solution has cooled off, the cloth will show up the presence of cotton, and also the relative amount in it. The acid solution dissolves the cotton and works havoc with it. If the fabric is all cotton there will be very little left in the dish except a muddy sediment, and if mostly cotton, with some wool in it, the cloth will fall all apart. If it presents a sieve-like appearance cotton is woven in with the wool to a moderate extent. It is only when the fabric comes out of the acid test whole that it can be pronounced all-wool. The effect of the acid on the wool is merely to turn it a dirty red color.

Alpaca, worsted mohair, and shoddy are tested in the same way as wool; but silk will hardly yield so readily to this chemical test. The difference, however, is chiefly in the kind of acid. A 5 per cent solution of nitric acid should be employed for testing silk. Pull from the edge of the silk cloth a number of yarns, making sure that they are from the warp and not from the weft, and dip these one by one in the solution. In this case if they are cotton yarns they will undergo no change, but if they are silk they will turn yellow. If there is any further doubt the weft yarns can be tested in the same way. Any other vegetable fiber besides cotton will show no change when dipped in the nitric acid solution, but silk always will.

In the manufacture of silk goods such tests are quite necessary to-day, for many grades of cheap satins and heavy silks are made which would deceive any except the experts. Some of these have the cotton mixed in with the warp yarns, and by means of patent processes of finishing its presence cannot be detected. Other grades have a cotton back and a pure-silk face. Usually this is so apparent that there is no attempt made to deceive. If such is the case a drop of the acid solution on the back and another on the face would reveal the story. A fiber known as artificial silk is sometimes used to adulterate pure silk goods, and the ordinary silk test described does not affect it. But this so-called artificial silk is a chemical production, and it is so inflammable that it is only necessary to apply a match to a piece of the goods to make it burn violently and reveal the deception.

In linen goods cotton cannot be detected by any of the above tests, and in fact it is here that the greatest difficulty is experienced. Our towels, crashes and heavy damasks are often adulterated with cotton, and it is quite necessary to be able to tell the difference between the pure linen goods and the adulterated. Even pure linen will sometimes pass for pure cotton, so artful are the processes of manufacture. Yet in the case of a handkerchief, a simple process will suffice. Moisten the finger and press it against the handkerchief. If it is pure linen the fabric will absorb the moisture quickly and make it wet on the opposite side. If it is all cotton the absorption of the moisture will be slow, and it will take a good deal to make the wet pass through to the opposite side.

But when the linen fabric has only a portion of its yarns of cotton, it is necessary to resort to an acid test. A 5 per cent solution of caustic potash or caustic soda should be used for this purpose. In half a gill of water dissolve a piece about the size of a walnut. After this has stood a few moments dip the warp yarns of the linen and cotton fabric in it. They should be left in the liquid for about fifteen minutes. The solution will make the cotton yarn contract and, if anything, increase its strength, but it softens and makes very pliable the linen yarns. Thus the material will readily pull apart if all linen, and it will be strong and firm if cotton. By immersing a piece of the fabric in the solution it should pull apart easily if made of part cotton and linen, but remain strong if all cotton.

Mercerized cotton is one of the new process goods that looks a good deal like silk and has a luster all of its own. When it passes as mercerized cotton it is well known, and no deception is intended, but it is often used in knit underwear goods, hosiery and gloves under other names, and thus may sometimes be passed off on the unsuspecting as pure or part silk goods. The silk test, however, will reveal the cotton in the material. More recently successful efforts have been made to dye mercerized cotton. Mercerized cotton is now dyed in nearly all the prevailing shades, but the work is a delicate one and requires careful manipulation. This makes the use of the prepared fabric more general than ever, and also opens the way for deceiving the purchaser who takes his goods on faith from dishonest dealers.

BARON NORDENSKJÖLD DEAD.

Baron Nordenskjöld, the Arctic explorer and discoverer of the Northeast Passage, died at Stockholm on August 12. He was a Finn by birth, and received a scientific education. He accompanied an exploring party to Spitzbergen in 1858, after having been appointed Professor in the Royal Museum of Stockholm. He made other trips to Stockholm in 1861, 1864 and 1868. He visited Greenland in 1870 and 1875. In 1876 he made arrangements for his successful attempt to accomplish the Northeast Passage. In July, 1878, he started in the "Vega". The vessel wintered near Behring Strait, and was free of ice in July, 1879, reaching Japan on September 2 of that year. In 1883 he made a second voyage to Greenland, and succeeded in penetrating with the ship through the dangerous ice barrier along the east coast of that country south of the polar circle.

SCIENCE NOTES.

The use of sun bonnets as a head covering for horses in summer is very much on the increase, both in this country and in England. Straw seems to be the favored material, but in England wire framework covered with light calico is also used.

The Council of the University of Birmingham, England, has appointed W. J. Ashley, Professor of Economics at Harvard University, to be the incumbent of the first organizing chair of the future Faculty of Commerce. Such a faculty appears for the first time in university history.

The Agricultural Society of Italy has offered prizes of nearly $200 for a reliable method of ascertaining the quality of sulphur and of mixtures of sulphur with sulphate of copper. Sulphur is largely used in Italy for diseases of plants, and much of the product sold is inferior. The competition is international.

Encke's comet, which has just returned to visibility, was observed by Dr. William R. Brooks at the Smith Observatory, Geneva, N. Y., on the morning of August 11. At that time it was in Gemini about ten degrees west of Castor. Its position at 3 o'clock was right ascension 6h. 35m. 30s.; declination north, 31 deg. 17m. The comet is moving in a southeasterly direction and approaching the sun. On August 11 it was just visible in the 3-inch finder of the 10-inch equatorial, and as the comet is increasing in brightness it will be observable with quite moderate apertures. The comet is globular in form, and at present without a tail. Professor Brooks says that a short tail may be thrown out as the comet approaches perihelion. Encke's comet has the shortest period of any known comet—three and one-third years.

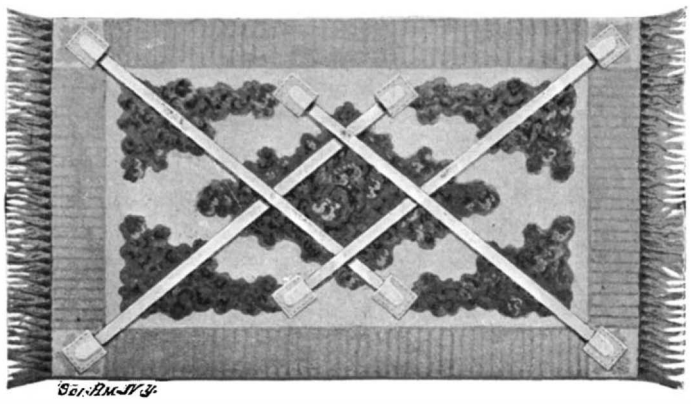
The Census Bureau has made public its figures giving the population by sex, nativity, and color of a group of states, including Indiana, Iowa, Kansas, and Indian Territory, the results being as follows: Indiana—Males, 1,285,404; females, 1,231,058; native, 2,374,341; foreign, 142,121; white, 2,458,532; colored, 57,960. Of the colored 207 are Chinese, 5 Japanese, 243 Indians and the remainder negroes. Indian Territory—Males, 208,952; females, 183,108; native, 387,202; white, 302,680; colored, 89,380. Of those classified as colored 36,853 are negroes, 27 Chinese, 1,107 Indians taxed, and 51,393 Indians not taxed. Iowa—Males, 1,156,849; females, 1,075,004; native, 1,925,933; foreign, 305,920; white, 2,218,667; colored, 13,186, including 12,693 negroes, 104 Chinese, 7 Japanese, and 382 Indians. Kansas—Males, 768,716; females, 701,779; native, 1,343,810; foreign, 126,685; white, 1,416,319; colored, 54,176, including 52,003 negroes, 39 Chinese, 4 Japanese and 2,130 Indians. The Census Office also issued a bulletin on the manufacturing industries of the four Territories of Arizona, New Mexico, Oklahoma, and Indian Territory, showing an aggregate product of $37,897,103. Arizona leads with a product of $21,315,169, of which amount $12,286,517 was the output of the copper smelters. The total product for New Mexico is $5,605,795; for Indian Territory, $3,892,181, and for Oklahoma, $7,083,938.—Bradstreets.

That driest of all the American States, Arizona, has just come into possession of a seaport, observes the Cincinnati Times-Star. A steamship line has been chartered to ply on the Colorado River from the Gulf of California to Yuma. This little city, situated in the midst of an arid desert, and parched by the eternal sun of the Southwest, thus comes into direct communication by sea with the outside world. At the present time only the smaller class of vessels can navigate the lower waters of the Colorado. It is hoped, however, that the work of dredging the stream will be soon undertaken, and that in time the larger seagoing vessels will be enabled to advance to the wharves of Yuma. The opening of Arizona and southwestern California to direct communication with the sea cannot fail to be of immense advantage to this region. The country is extremely fertile. Only a little irrigation is required to make Arizona one of the most productive states in the Union. Irrigation schemes have formerly been hampered, however, by the lack of suitable facilities for the cheap transportation for the state's products to the seaboard. With the opening of a waterway to the sea Arizona should show a marvelous development. What has been done in California can be done again in Arizona. And when the change takes place the opening up of a waterway to Yuma will have played an all-important part in the development of Uncle Sam's great territory.

A DEVICE FOR STRAIGHTENING RUGS.

Our illustration pictures a simple device invented by George T. Weeks, of Edon, Ohio, for straightening rugs and door-mats and preventing the corners from turning up.

The straightener consists merely of stretcher-rods pivoted in pairs, the ends entering pockets secured to the rug or mat. The rods are stitched to the rug to hold them in place. By means of the light, extensible frame formed by each pair of stretcher-rods, the rug is kept flat and held in its place. Since the stretcher-rods are applied to the bottom of the rug, the straightening means are not visible.



THE STRAIGHTENER APPLIED TO THE BOTTOM OF A RUG.

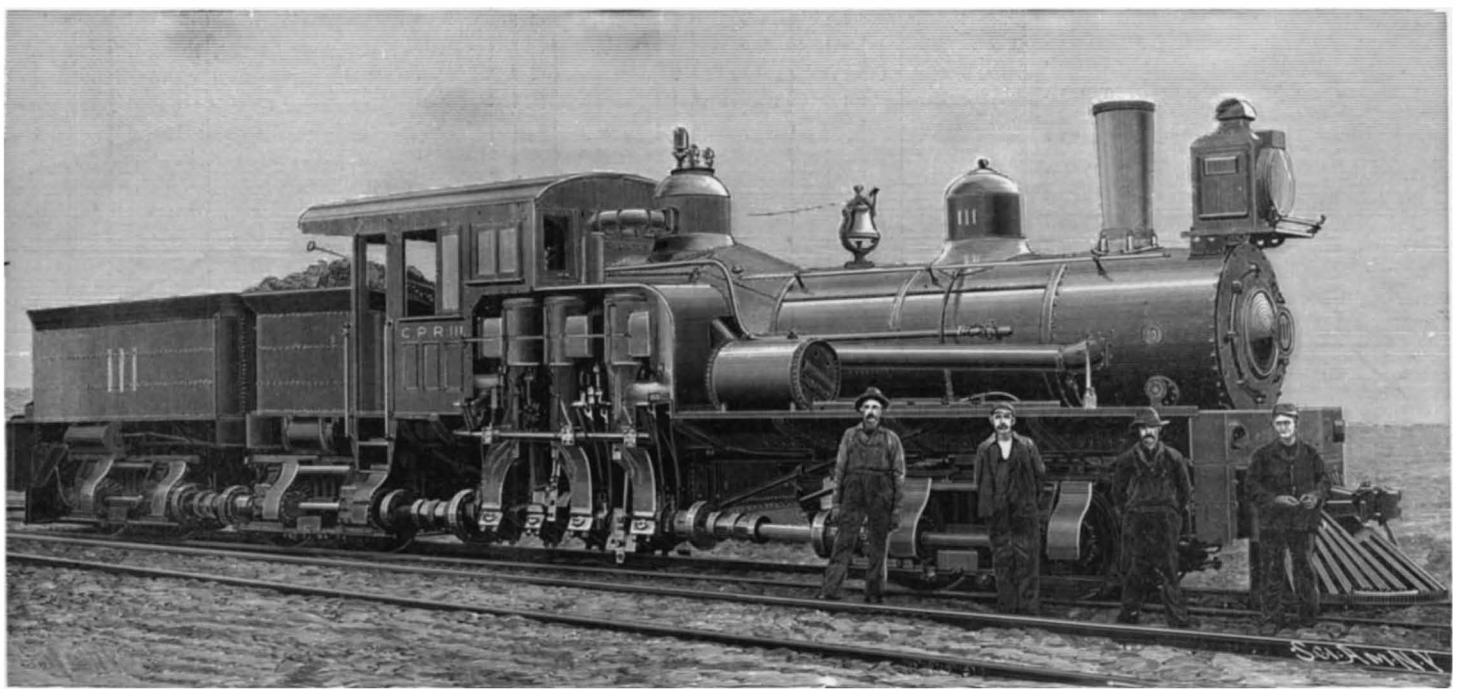
FREIGHT LOCOMOTIVE FOR HEAVY GRADES.

The accompanying illustration represents a successful attempt to provide a locomotive of great tractive power for use on grades of exceptional severity. It is owned by the Canadian Pacific Railroad, and is used on a stretch of road between the mining camps of Rossland, British Columbia, and the smelter at Trail. From Rossland to Trail the distance, on a direct line, is about 7 miles, whereas the distance by the railroad, owing to the excessive curvature used in securing as easy a grade as practicable, is more than 12 miles. The grades are in favor of the freight, which consists of heavy train-loads of ore; but on the return journey the excessive grade of 4½ per cent renders the work of hauling up to the mines the empty, but very heavy, ore cars a task of considerable difficulty.

It was with a view to increasing the load of empties that could be hauled at one trip that the Canadian Pacific purchased the engine which is herewith illustrated. It is known as the Shay locomotive, and is so called after its inventor. It was built at Lima, O., and has been in operation on the Canadian Pacific road since last fall. The locomotive is carried on two 4-wheeled trucks, one beneath the front end of the boiler, and the other beneath the coal-pocket, which is located immediately to the rear of the cab. The water-tender is carried on a single truck, and, as will be noticed, it is very short, serving merely for carrying water, for which it has a capacity of 2,900 gallons. The coal-box has a capacity of 6 tons. Although we have spoken of the water-tender as being separate, it might perhaps be more correctly described as incorporated with the locomotive, inasmuch as the weight of the tender is utilized for adhesion. In place of the customary two cylinders beneath the smoke-box, working direct upon the drivers, the engine consists of three high-pressure cylinders, 15 inches diameter by 17 inches stroke, which are carried upon the right-hand side of the boiler at the front end of the cab, and are arranged vertically above a longitudinal driving-shaft which extends the full length of the engine. This driving shaft, which is 6 inches in diameter, is arranged in sections, with two universal couplings between each of the three trucks, the arrangement being such as to give the trucks full flexibility for taking the curves. The flexibility, indeed, is such that the locomotive can round with ease much sharper curves than with the ordinary type, and it is claimed it is less liable to derailment. The wheels are all utilized as drivers. They are 40 inches in diameter, the width of the tire, including the flange, being 8 inches.

The crank-shaft is carried upon the frame of the engines, and the coupled-up lengths of the main shaft are carried in heavy journals, which are bolted to the frames of the trucks. Upon the driving shaft, opposite each wheel, is keyed a 20-tooth pinion, and on the outer face of each wheel is secured a heavy 41-toothed spur wheel. Particular care has been taken in the design of the main-shaft journals and in the cutting and fitting of the gears, with the result that when the engine is working at its full power, the teeth mesh smoothly, and, apparently, with a minimum of friction.

The total weight of the locomotive, when in working order, is 112 tons—a weight which is only exceeded by a few of the latest locomotives built for the ore-carrying railroads of the East. Results of operation show that, as the result of her whole weight being available for adhesion, and of the advantage gained by being geared down in the ratio of 2 to 1, this locomotive will haul about twice the load that can be hauled by the ordinary "consolidations" of the road. The speed, of course, is low on a grade of such a heavy character, the average rate with a full load, on a 4 per cent grade, being about 10 miles an hour. The engine is of such interest that we subjoin a few further particulars. The gage is the standard of the road—4 feet 8½ inches. The boiler is of the wagon-type pattern, and carries a working pressure of 180 pounds to the square inch. The tube-heating surface is 1,407 square feet; the firebox has a heating surface of 147 square feet, and the grate area is 27.8 square feet, making a total of 1,554 square feet.



FREIGHT LOCOMOTIVE FOR HEAVY GRADES.

Hygroscopic Movements in Plants.

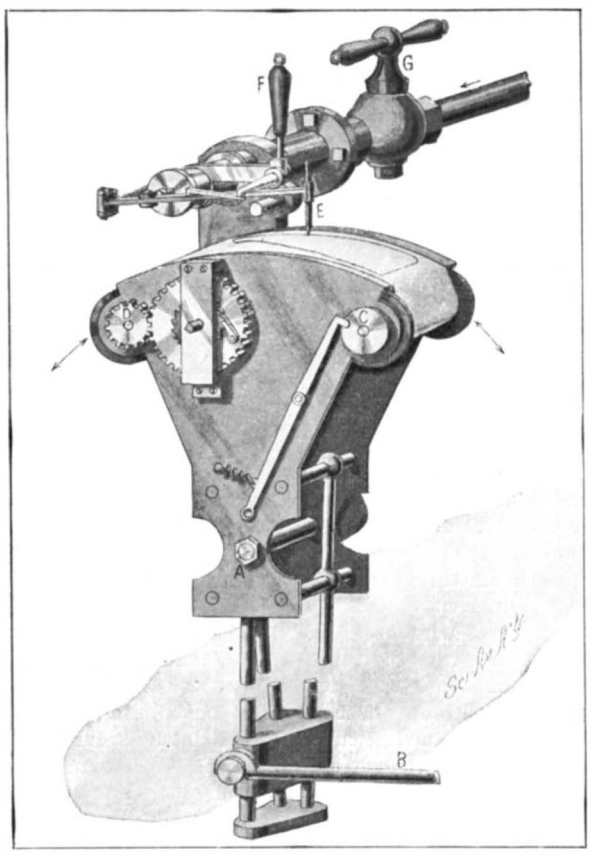
Dr. U. Giovannozzi classifies the various hygroscopic movements of plants under six heads, viz.: (1) Movements for the protection of pollen (bracts of *Cynaraceæ* opening and closing of anthers); (2) for protection against desiccation (thallus of *Hepaticæ*, mosses, grasses, etc.); (3) opening and closing of fruits; (4) for the dispersion or burying of seeds (torsion of the awns of *Geraniaceæ* and grasses); (5) for the dissemination of spores (annulus of ferns, fungi, lichens, *algæ*); (6) movements of the branches of conifers. The most common mechanism which produces hygroscopic movements is the superposition of two tissues, one of which has a greater capacity for swelling than the other. Compact tissues, composed of thick-walled, and especially of sclerenchymatous cells, have in general a greater capacity for absorbing water than those composed of thin-walled cells. Torsion, as in the awns of *Geraniaceæ* and *Stipa*, the legumes of *Papilionaceæ*, etc., results from the presence of a very hygroscopic tissue on the face which is internal in respect to the torsion. The protection of the pollen in the fruits of *Cynaraceæ* is effected by the movements of special organs, the bracts of the involucre. Hygroscopic movements may take place in dead as well as in living tissues.—Nuov. Giorn. Bot. Ital.

The construction of a railway under the Solent is planned. The railway, including the tunnel, would be about 7½ miles in length, and would in all probability be operated by electricity.

A SIMPLE LOCOMOTIVE ENGINE INDICATOR.

By means of a new indicator which has been invented by Eric Norden, of Wilmington, N. C., it is possible to take a succession of indicator-diagrams from steam engines without marking over the same card. The indicator is particularly serviceable for making locomotive engine charts without the necessity of the engineer's leaving his cab.

The card is in the form of a continuous strip of paper carried by a pendulum connected with the cross-head by a member, *B*, so as to swing and move the card in one direction, while the pencil is moved transversely by the cylinder pressure. The pendulum consists of two rigidly connected plates which are joined at their upper edges by an arc-plate struck from the center of oscillation of the pendulum. Between the plates two winding drums, *D* and *C*, are mounted, the card passing from one to the other over the arc-plate. The drum, *D*, is driven by a spring motor; the drum, *C*, is held at intervals against rotation by a spring-pressed lever which is arranged to enter a notch in a disk on the shaft of the drum, *C*. Thus the card is shifted after a diagram has been made and held stationary while the pencil is in operation.



THE NORDEN LOCOMOTIVE ENGINE INDICATOR.

The pencil, *E*, is carried on the end of an arm, connected with a piston-rod working in the reduced extension of the cylinder. The pencil-arm is connected by a system of links with a bracket pivotally mounted on the reduced extension. A handle, *F*, is secured to the bracket and is operated by a cord to swing the pencil into position. By adjusting the handle the pencil's position relatively to the card is regulated. To operate the device from the cab, the handle of the three-way cock, *G*, is provided with cords. The releasing lever of the winding drum is likewise provided with a cord. Thus there are four cords, two of which control the steam pressure, one the movement of the pencil to the card, while one releases the card to permit its onward movement.

The instrument is an indicator and reducing-motion in one, and takes consecutive cards at short intervals. It is the opinion of the Department of Tests of the Baldwin Locomotive Works that the device is of considerable value.

MODERN GRAIN ELEVATORS.

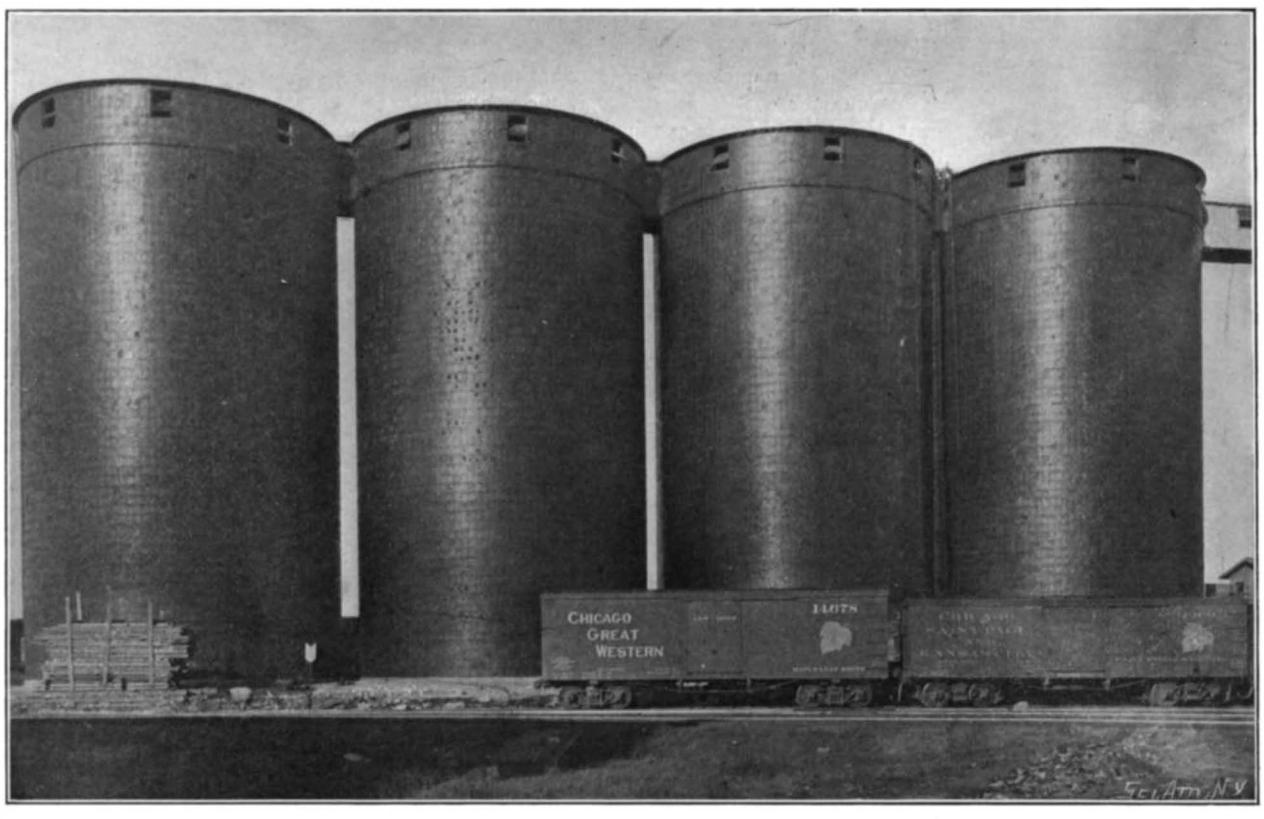
Of late years there have been some very radical changes made in the method of construction of the huge elevators which figure so largely in the storage and handling of grain. Not only have they increased enormously in capacity, but the form and materials of construction have been conformed to modern engineering methods.

We present illustrations of two of the latest elevators erected in Minneapolis, each of which represents an entirely different method of construction. One of the largest items of expense in connection with the elevator business is insurance, and the changes in construction, which we have referred to, have been brought about as much, and perhaps more, by the desire to lessen the insurance rates, as to provide elevators of vastly increased capacity.

FIREPROOF STEEL TANK ELEVATOR OF 1,200,000 BUSHELS CAPACITY.
Tanks 55 feet in Diameter by 80 feet in Height.

The larger of the two elevators shown is that of the Pioneer Steel Elevator Company. It was constructed by the Barnett & Record Company, and is located on the tracks of the Great Northern, the Sault, and the Northern Pacific Railroads. The total capacity of the plant is 1,200,000 bushels. At the center is seen the working house, which covers 70 x 84 feet of ground. This is a steel building, the floors of which are of composite steel and concrete construction. Double tracks run through the building on the ground floor, all of which floor is devoted to unloading and cleaning the grain. It has a capacity of 50 cars in and 50 cars out every day. The building contains 35 steel, hopper-bottom bins. On the ground floor are four large special cleaners, with a capacity of 25,000 bushels per day, two large wheat cleaners and one oat clipper. Above the bins, the frame of the building is of structural steel work, with a covering of corrugated iron. The total height of the working house is 145 feet. On either side is a line of five cylindrical steel tanks, each 55 feet in diameter by 80 feet in height, and capable of holding 100,000 bushels. The covered way which will be noticed, extending either way from the working house above the roof of the tanks, contains a belt conveyor, and a similar conveyor extends beneath the floor of the tanks. The power house contains a 250-horse power engine, and the rope-drive is used through the whole of the plant. The power house, working house, tanks, and, indeed, the whole plant, is considered to be absolutely fireproof.

Another form of fireproof construction has been used in the four-tank elevator which has recently been put up by the Barnett & Record Company, for the Great Eastern Elevator Company. It is constructed on what is known as the hollow-tile bin system, the walls of the tanks being constructed entirely of hollow tiles tied at intervals with steel rods. The method of construction is as follows: The tiles are set on edge in a tile base, which is tied by steel rods which run around the circumference of the tank. When a complete circle of the tiles has been placed, another tile base is put in position; and the operation is repeated until the full height of the bin is reached. On the inside of this wall is cemented a circle of white, vitrified tiling, placed with the openings or flues vertical, the result being that continuous air-shafts are formed through the wall from top to bottom. The four tanks are each 50 feet in diameter by 80 feet in height, the total capacity being 400,000 bushels. In a test made of this system at a time when the thermometer stood at 15 deg. above zero in the open, water and snow were applied to the interior of a section of the wall and allowed to freeze into a solid cake, while against the outer wall there was erected a furnace in which a fire was started and forced, until the pyrometer showed a temperature of 2,000 deg. It was not until the fire had been banked that the ice on the inside began to melt, and after the last of the fire had died away there was still some ice and snow remaining against the inner wall of the tank. In view of the results thus obtained, it is claimed that the contents of a tile tank are proof against injury by fire.



FIREPROOF TILE TANK ELEVATOR OF 400,000 BUSHELS CAPACITY.
Tanks 50 feet in Diameter by 80 feet in Height.

All from Coal-Tar.

As is well known, coal-tar, a by-product in the manufacture of ordinary coal-gas is a wonderfully complex substance, says The Spatula. No less than sixty different substances have been discovered in it, and more are being discovered every year.

One of the most interesting of these is benzine—a clear, mobile liquid discovered in gas oils by Michael Faraday in 1825. It is used in enormous quantities for the production of aniline, and also of a powerful perfume known as artificial oil of bitter almonds, or essence of mirbane. No less than 150 tons of this perfume are used in scenting soaps and other toilet requisites. Benzine has the useful property of dissolving fats, resins and india rubber, and is therefore of much value in the cleansing of goods by the dry cleaning method, and also in the forming of india rubber solution, so well known to lovers of the cycle and the football. In 1820 naphthalene was discovered in tar by Garden. This is a substance from which we derive some of our most beautiful colors, ranging from a buttercup yellow on the one hand to reds, pinks, greens, and scarlets. To entomologists this naphthalene is of interest, as it is now considered the best preservative for cases of moths, butterflies, insects, and other natural history specimens.

In 1832 anthracene was discovered by Dumas. It is now of immense importance, as it forms the base from which that beautiful and well known color Turkey red is now obtained. From time immemorial this valuable dye has been derived from the roots of the madder plant, the coloring principle of which is called alizarin. But in 1868 two German chemists, Graebe and Libermann, discovered a method of making artificial alizarin from the coal-tar product anthracene—a discovery which has completely revolutionized the dyeing and calico-printing industries. The excitement in the dyeing and coal-tar industries was immense. Anthracene, which formerly was considered a useless by-product, sold at a few shillings a ton and utilized as a cart grease, immediately rose in price and shortly after this discovery commanded something like $500 a ton. This artificial alizarin has now entirely superseded the natural product from the madder plant; and the cultivation of madder, which was once a great and flourishing industry, has now dwindled away, and in the course of a few years will probably be altogether extinct.

Phenol, or carbolic acid, discovered by Mitscherlich in 1834, being one of the most powerful antiseptics and disinfectants, purifies the atmosphere from noxious gases and destroys the infectious germs of disease. Its valuable antiseptic properties have been introduced into surgery with great success by the present Lord Lister, president of the Royal Society. From carbolic acid is obtained a valuable series of coloring matters, ranging from a beautiful yellow, i. e., picric acid, to reds, oranges, browns and many other colors.

The wonderful substance, aniline, is found only in small quantities in coal-tar, and its production on a sufficiently large scale for industrial purposes only became possible when Zinin, in 1842, showed it could be made from nitro-benzine, or the artificial oil of bitter almonds, already mentioned. All the aniline for the production of the innumerable beautiful colors is obtained from this derivative of benzine. In 1856 Dr. William H. Perkin, then a young man of 18, was engaged experimenting on aniline with a view of making an artificial quinine. Though his experiments in that direction were a failure, they were the means of his making the great discovery of the first aniline color, namely, mauve, and from these experiments has arisen a world-wide industry. In 1858, Prof. A. W. Hofmann discovered the magnificent color magenta, or aniline red, one of the most brilliant colors known to the dyer. Then came in quick succession greens, violets, blues and yellow coloring matters, all the hues of the rainbow, and at the present day the number and varieties of colors are bewildering.

We are indebted to coal-tar not only for beautiful

colors, but also for some of our most valuable drugs. The valuable drug antipyrine, discovered in 1883 by Dr. Knorr, of Erlangen, is considered even better than quinine as an assuager of fevers, and is much cheaper in price. Another is thallium, discovered by Skraup, which has the special power of mitigating yellow fever, or the "yellow Jack," the dread of every colonist. Phenacetine is still another, possessing valuable antipyretic properties. Sulphonal, discovered by Prof. Baeyer, is a hypnotic. But perhaps the most remarkable substance obtained from tar is saccharine, 220 times sweeter than cane-sugar, useful for sweetening fruit preserves, jams, jellies, etc., where ordinary cane-sugar would mold and ferment in course of time. A most interesting and important property is that it does not nourish and fatten the body as cane-sugar does. Hence it is of value in certain troubles like diabetes, where it is often recommended by the physician for sweetening tea or coffee in place of cane-sugar.

Vanilin, now obtained from this tar, is a delicate flavoring essence resembling the true vanilla from the vanilla bean, and the cultivation of the plant in the Cordilleras and Mauritius has been greatly restricted from the introduction of this artificial vanilla. By mixing essence of mirbane with a certain proportion of this coal-tar vanilla, Lord Roscoe has prepared a delightful perfume known as white heliotrope, and many of the pleasant perfumes which play an important part in the toilet of every pretty maiden and courtly dame are extracted, by the magic of chemistry, from that black and ill-smelling substance, tar.

Glycin and Hydroquinone Developer.

After considerable experiment we have found the combined glycin and hydroquinone developer to be not only very effective and durable, but also one of the cleanest yet tried, which makes it particularly suitable for amateurs whose dark rooms have to be bath rooms, for it will not stain marble, towels, or the hands, should any of the developer come in contact with them.

It is also a very flexible developer, capable of being adjusted to most any kind of exposure, by simply adding, from time to time during development, a few drops at a time of the carbonate of potash solution, strength of one ounce dissolved in ten ounces of water, or instead, a solution which has previously been used and kept for a few days.

In one mixing it is possible to develop two dozen plates in succession, one as clear as the other. The developer is absolutely free from producing chemical fog, even during prolonged development.

Two solutions are prepared as follows:

No. 1.

Glycin (Hauff)	180 grains or	12 grammes.
Hydroquinone	60 grains or	4 grammes.
Carbonate of potash	180 grains or	12 grammes.
Sulphite of soda, crystals	690 grains or	45 grammes.
Water, hot or very warm	10½ oz. or	300 c. c.

In hot weather it is advisable to preserve it in small bottles, and place in lower part of icebox.

No. 2.

Carbonate of potash	1 oz.
Water (cold)	10 oz.

For use, take one part of Solution No. 1 and two parts of No. 2. Bromide of potassium is not necessary, as the negatives will be clear without it.

With a slight modification it is possible to produce with this developer very good negatives from plates which have been greatly overexposed by using the following solution:

No. 3.

Glycin	75 grains or	5 grammes.
Sulphite of soda, crystals	450 grains or	30 grammes.
Carbonate of potash	390 grains or	26 grammes.
Bromide of potash	15 grains or	1 gram.
Water, warm	20 ozs. or	625 c. c.

This solution can also be used repeatedly. For doubtful cases, as an overexposure, it will be a very sure way to use half and half. That is, mix of Solutions No. 1 and No. 2 only half the quantity needed, and add the other half from Solution No. 3.

For ordinary exposures with the developer showing a temperature of 70 deg. F., the image usually appears in about twenty seconds after the plate is covered with the developer, and development is generally completed in about four to five minutes. If at this time the plate is not sufficiently dense when viewed by transmitted light, it is only necessary to continue the development until the desired density is reached.

Electromotive Force Developed Between Magnetized and Unmagnetized Iron.

It has been found that if two iron electrodes are placed in acidulated water, one of these, upon being magnetized, becomes positive to the other, causing an electromotive force to be set up. The experiments of Dr. Hurmuzescu have shown that up to a magnetization of 7,000 units the curve which unites the electromotive force to the strength of the magnetic field developed in the iron has a form analogous to the curve of magnetization of iron, that is, the electromotive force, increasing at first with an increase of magnetization, afterward increases more slowly. M. René Paillot has extended these researches to very intense magnetic fields, and finds that the electromotive force seems to arrive at a limit beyond which it cannot be increased by further magnetizing the iron. In order to reach this limit a very intense magnetic field was needed, and this was obtained by using the semicircular electromagnet devised by Dubois, by which in the intrapolar space a magnetic field as high as 30,000 units is obtained. The experiment was carried out with electrodes in the form of iron wire carefully annealed; these were placed in the vertical branches of a tube bent up at each end, and filled with a dilute solution of acetic or oxalic acid. One of the branches of the tube, containing an electrode, is placed in the magnetic field between the poles, and as the lower straight portion is 12 inches long, the second branch with its electrode is entirely outside the field. The electromotive force, which was very small, was read by a Lippmann electro-capillary voltmeter, sensitive to the 10,000th part of a volt. The magnetic field was measured by the ballistic galvanometer. A number of observations were made, which agreed very closely, and the results are expressed in the following table:

Field strength H.	Electromotive force volts.	Field strength H.	Electromotive force volts.
804	0.0022	20210	0.0298
1698	.0040	23492	.0320
3106	.0074	24500	.0324
5000	.0110	26505	.0330
8712	.0171	27018	.0328
10504	.0191	28886	.0330
12193	.0210	29510	.0332
17043	.0272	30187	.0330

It will thus be seen that the electromotive force developed between magnetized and unmagnetized iron cannot be made to pass a certain limit. This limit, which is 0.0330 volt, is reached when the iron is magnetized to 25,000 units, and is not increased at a field-strength of 30,000 units, which is about as high as can well be obtained. The value of this limit depends somewhat upon the sample of iron and the strength of the acid, but does not vary greatly from the above.

STEAM HEAT WITH CONDENSING ENGINES.

BY ALTON D. ADAMS.

Industrial works have usually to choose between condensing engines and exhaust steam heat. If condensers are used, most of the heat of steam is rejected in their water, and the heating system must be supplied from the boilers. Should it be decided to use the exhaust steam in the radiating surface, at a little more than atmospheric pressure, the power and efficiency of the engine both suffer not only by the absence of a partial vacuum, but also from the positive back pressure. A compromise is sometimes adopted, by using condensers in the summer and the exhaust steam for heating purposes in the winter. This expedient makes a very material difference between the power of engines in warm and cold weather, also in the amount of coal consumed. The steam consumption per indicated horse power increases by 25 to 30 per cent during the cold season. Besides this loss of efficiency, the maximum power of an engine, working at one-quarter cut-off, would be reduced about 27 per cent by changing the exhaust connections from condenser to heating system, provided that five pounds back pressure is carried in the exhaust steam-pipes. Fortunately it is no longer necessary either to waste the heat of exhaust steam, when wanted for heating purposes, or to reduce by one-quarter the efficiency and outputs of engines during one half of each year. A vacuum of 26 inches may receive the engine exhaust for twelve months of the year, and the heat of this steam be applied for general warming to any extent desired. This desirable result is accomplished through the vacuum system of steam heating. The heating surface of this system, when operating with exhaust steam, does the work of a condenser; that is, it changes the steam to water and thus produces a partial vacuum. The latent heat of the steam, instead of heating condensing water, warms the air of spaces in which radiators are placed. The latent heat of steam in a partial vacuum is even greater per pound than at atmospheric pressure, and the heating power of the engine exhaust remains nearly constant, whatever the pressure, if rightly applied. To ensure the constant flow and condensation of steam throughout the heating system, air and water must be removed from the radiating surface as fast as they accumulate. This is effected by arrangements of suction pipes and valves that ensure the removal of air while they prevent its entry, and by suitable return pipes for the water.

As a result, the heating system when in use is constantly filled with steam of the pressure at which the vacuum is operated. The radiating surface for general warming will obviously have its greatest condensing action in the coldest weather. If this surface for general warming is the only one that may be used to maintain the vacuum, this vacuum must vary with the outside temperature. To avoid such variation of the vacuum against which the engines work, and to provide for condensation during hot weather, a condenser of one of the usual types should be provided, to operate in connection with the general heating system. If the exhaust is only sufficient for warming purposes in the coldest weather, the vacuum will be maintained by the condensation in the heating system. In warmer weather a part of the exhaust must be condensed by the use of water in the condenser, and when no general warming is required the regular type of condenser may do all of the cooling. This use of a heating system as a condenser for engines saves either the entire cost of fuel for general warming during the winter, or adds a material per cent to engine capacity and efficiency. The temperature of steam is only about 140 deg. F. in a vacuum of 24 inches. In other words, each pound of steam on condensation in a high vacuum gives up more heat units than at open air pressure, but the temperature at which this energy is liberated is greatly reduced. The vacuum heating system will warm as much space with a given weight of exhaust steam, as though operated at or slightly above atmospheric pressure, but a much larger amount of radiating surface must be employed for the purpose. Radiating surface is effective for warming purposes in proportion to its elevation in temperature above that of the surrounding air. The actual amount of heat given off per hour by a square foot of radiator surface per degree of temperature difference, varies with its construction, the movement of the air and other factors, but two heat units may be taken as an average figure. On this basis one square foot of radiation, supplied with steam at five pounds above atmospheric pressure, and with a temperature of 227 deg., delivers 314 heat units per hour to air at 70 deg. temperature. In contrast with this result, one square foot of radiator surface, heated by steam in a vacuum of 24 inches, has a temperature of 140 deg. and supplies only 140 heat units per hour to the surrounding air at 70 deg. under like conditions. To produce the same general heating effect the vacuum system must, therefore, contain two and one-quarter times the radiating surface that would be necessary for steam at five pounds pressure. Assuming that one square foot of radiating surface is in use 1,500 hours per year, at five pounds pressure, with surrounding air at 70 deg. F., it gives off 471,000 heat units during that period. If steam for this heat is taken directly from a boiler with an efficiency of 70 per cent, the coal consumed per square foot of heating surface must contain 672,888 heat units. At 13,500 heat units per pound, the coal per year for each square foot of radiation amounts to fifty pounds. With coal at $3 per ton, fifty pounds cost 7.5 cents. In order to use the vacuum system of heating with steam from condensing engines as above, one and one-quarter square feet of radiating surface must be added to each square foot necessary with steam at five pounds above air pressure, to give off an equal amount of heat. No increase is required for the vacuum system in the size of pipes to the heating surface, since the necessary weight of steam is not larger than at five pounds pressure. The cost of 1.25 square feet of rough heating surface, constructed with 1 or 1.25-inch pipe, as is common in industrial works, is 15 to 20 cents. Coal alone, during a single season was found to cost yearly 7.5 cents per square foot of heating surface in a system at five pounds pressure. When to this fuel outlay there is added the interest on investment for boilers to supply the heating system independent of the exhaust steam, the total will probably equal the cost of extra heating surface for the vacuum system in a single year. If the cost of decreased capacity and efficiency at the steam engine is figured for the case where condensing operation is abandoned, in order to supply exhaust to a heating system, this cost will be found to represent a very large annual interest on an outlay for the additional heating surface necessary in a vacuum system.

In summer as well as in winter the heat of exhaust steam from condensing engines may be put to useful work. Among the most commonly desired effects in summer are cooling and ice making. These processes are readily carried on by the heat of vacuum exhaust, on the absorption system of refrigeration. On this system, heat instead of mechanical power supplies most of the energy necessary to keep up the set of operations by which ammonia conveys heat from the substances cooled. This heat can be extracted from tubes in which the engine exhaust condenses, by the ammonia solution.

Where condensers are operated only during the summer, the exhaust is used for steam heating at a little above atmospheric pressure in the winter.

The law enacted at the last session of the Connecticut Legislature regarding the speed of automobiles went into effect August 1. The law limits the speed of all power vehicles to 12 miles an hour in cities and 15 miles on the country roads. If the driver of a horse holds up his hand to an approaching automobile the operator must stop immediately. A penalty of not over $200 is attached to the statute.

Automobile News.

It is said that the Mors racers of 28 nominal horse power, of which several, including Fournier's, were in the Paris-Berlin race, are required to do a kilometer in 32 seconds before they are passed by the makers. This is just a shade under 70 miles an hour. The nominal power of these machines is believed to be much less than the maximum of which they are capable. Their weight is put at 2,860 pounds, as against 2,640 pounds for the Panhards of the same nominal power, says The Automobile.

The 7 horse power Renault voiturettes which performed so remarkably in the same race are said to weigh but 870 pounds. They are fitted with De Dion motors, giving a maximum of 8-horse power.

Consul Chester reports from Budapest, June 29, 1901: The first Automobile Exposition in Hungary was opened on the 17th instant. About seventy machines were on exhibition. The only American make was that of the Locomobile Company of America, which was represented by two steam automobiles. It has only one agent in Vienna for the whole monarchy. The German firm of Benz & Company put on a motor machine, as did the French firms of Peugeot and Darrocq, all of which have appointed agents in Budapest. Austria was represented by Daimler & Company and the Braun Automobile Company, with a motor and an electrical machine, respectively. Hungary's home manufacture consisted of an electrical autotricycle made by Geza Szám, electrical engineer in that city. The Velodrom Company, of Budapest, agents for the Peugeot machine (French), made the best showing, with pleasure automobiles, government post-collection tricycles, and delivery wagons. American manufacturers should at once represent themselves here.

The coasting race from Spa to Malchamps, organized by the Belgian Automobile Club, was run on the 21st of July and proved an interesting event. This route has 3.4 miles of a very steep grade, such as is characteristic of the Ardennes region. Osmont, on a De Dion motocycle, was the winner, and climbed the grade at a speed of over 36 miles an hour, in 5 min. 21 2-5 sec., thus beating considerably the previous record made by Baron de Crawhez of 7 min. 21 sec. In the voiturette class (up to 880 pounds) Orban-Viot was the winner, in 12 min. 57 3-5 sec., on a De Dion machine. A much better performance was made by Baron Joseph de Crawhez on a 28 horse power Panhard machine, in the heavy vehicle class, or 7 min. 37 4-5 sec. In the light vehicle class, Roland, on a Gobron machine of 9 horse power, made 7 min. 46 1-5 sec. The weather was fine, and the race was watched by a large crowd. The coasting races organized in France and in Austria will no doubt prove equally interesting. The former of these has been fixed for the 11th of August, and takes place over the celebrated Raffrey grade, near Vizille, which is four miles long and slopes from 7 to 13 per cent, with an average of 9.3 per cent. It has been organized by the Dauphinois Club, and affords an excellent test for the machines. On the 15th of September will be held the Schottwien-Semmering coasting race, arranged by the Austrian Automobile Club. It will include motocycles, voiturettes, light and heavy machines, and a fifth class for electrics.

In the travels which the Etat-Major of the German army have been making through all parts of the country, automobiles and motocycles are used almost exclusively. The officers are thus enabled to cover a considerable stretch of country without fatigue, and to visit all the important military posts. The bicycle, with petroleum motor, is also coming into favor among the officers. In the grand maneuvers, horses are now almost entirely replaced by automobiles and bicycles for the officers' use. In France the coming maneuvers will be of exceptional importance, and it is said that a number of specially designed automobiles will be used. These have been carefully studied with a view to the various needs of the army and will be given a thorough trial. A notice has been recently issued that those who wish to make their annual 28 days of service during the fall maneuvers as automobilists with the machines belonging to them, are to make a demand to that effect at the recruiting offices. The daily allowance for these machines has been fixed this year at $2.40 per day for the voiturettes and $4 a day for the machines of 8 horse power and over, in addition to the regular army rates allowed to the soldiers. In Italy the Minister of War has decided to study a special type of military automobile which shall be adapted to all the services which such a machine should render in time of war. When this machine has been designed, the Minister of War will have a certain number of them built, and will then establish a series of annual prizes to be awarded to those of the constructors who show the greatest aptitude for building machines for army use. In this way the army will always know where to find the machines it may need at any given time, and will not be obliged to spend great sums every year in the construction of a type of machine which is constantly being improved.

Electrical Notes.

A 160-foot mast has been set up at Siasconset, Mass., for the wireless telegraph station which will receive messages from the Nantucket lightship. The ground connections were made by placing eight heavy metallic plates, 2½ by 8 feet, in the ground.

The cardinal's hat has been conferred upon Agostino Riboldi, Bishop of Pavia, who is well known for his work in physics, and especially in electricity. Several other ecclesiastics interested in electric subjects have recently been raised to the episcopal throne.

Nikola Tesla is about to establish his first wireless telegraph station at Wardenclyffe, nine miles from Port Jefferson, L. I. Two hundred acres of land have been purchased, and the necessary buildings will be put up at once. The main building will contain a 350-horse power electric plant. This will be the first of a chain of stations by means of which Mr. Tesla expects to communicate with all parts of the world.

An interesting report has recently been issued of the work done during 1900 by one of the chief Berlin laboratories, which make a special feature of analyzing calcium carbide and the various accessories required in acetylene generation according the specifications of the German Acetylen Verein, says the English Electrical Review. Of the samples of large carbide tested, 36 per cent evolved less than 285 liters of gas per kilometer (4.53 cubic feet per pound); 52 per cent evolved between 285 and 290 liters (4.53 to 4.62 feet); 8 per cent evolved between 290 and 300 liters (4.62 to 4.76 feet); and only 4 per cent gave more than 300 liters. The samples of granulated carbide gave on an average 210 liters (3.33 feet), the yield sometimes falling to 150 or 180 liters (2.4 to 2.9 feet); and much of this stuff was "guaranteed 300 liters."

The electrophone is enjoying increasing popularity in London. The London Electrophone Company have recently reduced their rates and now it will be possible for one to enjoy unlimited supplies of music, speeches, and so forth, for less than four cents per day. The company intend to reduce their tariff from its present rate of $50 to $12 per annum, and there will be no extra charges for installing the system into a private house, or for maintenance. The company has recently introduced several new devices in the apparatus which considerably improves it. One of the most important is a loud-sounding receiver. With this device it is only necessary to turn the switch, and everyone within the room in which the receiver is installed is able to hear. The instrument is already connected with the Grand Opera House, leading amusement halls and churches in the metropolis. The company also proposes to introduce a traveling telephone, applicable to railway carriages.

The telegraph department of the British Post Office has been carrying out some important experiments between London and Glasgow with a new device to cheapen the cost of transmitting telegrams. The apparatus is the invention of a French engineer named Mercadier, and by its application it is possible to forward twelve messages over one wire. The system may also be duplexed, so that when the exigency arises, twenty-four separate messages may be dispatched over the same wire. The apparatus is extremely simple in its design. At the sending end of the trunk wire are twelve short wires connected with twelve sending keys. The currents are interrupted by twelve rapidly vibrating metal reeds, each of which oscillates at a certain speed. At the receiving end of the wire are attached another set of twelve short wires, in this instance connected to twelve telephone receivers, each of which is fitted with a membrane capable of vibrating only at a rate synchronous with one of the vibrators at the sending end of the wire. When the messages are dispatched the twelve messages enter the wire with a certain vibration. When they arrive at the receiving station they pass through a microphonic receiver which increases their strength, and then each current enters the telephone receiver corresponding to its vibrations. Owing to the bad weather which has been experienced in England, the experiments have not been entirely successful, but when certain improvements in the apparatus have been embodied, there appears every possibility of the postal authorities adopting the invention. For some time past there has been an agitation in England for the reduction in the cost of transmitting telegrams. At present it costs twelve cents to forward a telegram of twelve words to any distance, and the public desires it to be reduced to six cents per message of the same length. The telegraph authorities contend that the expense of maintaining the wires and the cost of erecting new wires to cope with the increased traffic preclude the possibility of such a reduction being carried out until the cost of transmitting telegrams is reduced. The authorities hope that by means of this device it will be possible to increase the carrying capacity of the existent wires twelvefold, in which event the idea of six-cent telegrams will be realized. The new system is fully described in the current SUPPLEMENT.

Engineering Notes.

Comparison of the economy of the compound and triple-stage expansion types of engines in similar work and in vessels substantially the same, extending over one year in both cases, shows that the triple stage engine cost less for coal by 18 per cent, the cost of upkeep being no greater with one type than with the other.

On a private railroad, used chiefly to carry coal to and bricks from a brickyard in Prussia, a locomotive using alcohol as fuel is used. It was built for a society for the promotion of the use of spirits, which, in that part of the world, are largely produced in distilleries of large landholders, to utilize sirup produced in making beet sugar, unmarketable potatoes, etc.

Trade reports in various lines throughout the country, as shown by the journals representing manufacturing interests generally, say that there is no anxiety as to fall prices, nor any as regards the prevalence of strikes, outside of the loss of trade in districts immediately affected. No fears exist as to the crops and all lines are stocking up to be ready for trade when it arrives.

Contrary to the general belief the engines of torpedo boats are not at all extravagant in the use of steam, but approach high economy, considering that they are driven regardless of cost, the sole view being to get the highest possible piston speed in the shortest time with forced draft of greatest intensity—an air pressure of six inches in the fire-room in the case of the "Bagley," built by the Bath Iron Works. The coal burned per initial horse power was only 1.88 pounds per hour, with a consumption of 68 pounds per square foot of gas.

This paragraph from The Engineer, London, has a certain interest at this time: "As comparisons between English and American workmen are everlastingly cropping up, we quote from a local press representative who interviewed Mr. Stewart, in charge of the British Westinghouse Company's works at Trafford Park. He said: 'Well, I guess it's like this: The British workman (skilled man) works mighty hard and well; if you show you have some snap in you he will soon let you see that he possesses snap also. They soon fall into their work under our methods and we jog along well, getting the full quantity of work out of everybody.'"

The "American Invasion" continues to invade foreign countries, capturing large orders from the natives thereof, who profess to feel that they have hereditary rights in the trade of their own country which outlanders are bound to respect. The British Westinghouse Company has just placed a large order for a shop outfit of shafts and pulleys with the American Iron and Steel Works of Pittsburg, this concern having taken the contract against bidders from English and German manufacturers. An old adage says that there is no friendship in trade; there seems to be a lack of patriotism also, so called, which forbids people from buying at home when they can buy abroad at more satisfactory prices.

An icing station for refrigerator cars at Chicago is described in a recent issue of The American Engineer. The refrigerator cars are placed on a track beside a trestle which carries the ice cars, and the ice is run from the ice cars upon a long platform which is the right height to skid the ice into the tanks in the refrigerators. The approach to the trestle is inclined and is about 590 feet long. The icing platform is 156 feet long and is level. The trestle is 300 feet long and about one-half is on the grade. About 350 cars are iced per month, 4,000 to 4,500 pounds of ice being used for each car. With this arrangement the ice may be carried along the platform in a small truck, from which it is broken up and then dumped into the cars.

A foreign contemporary says: "Heavy censure has fallen upon English engineers because they have not constructed works for building locomotives. Why should orders go to the United States for railway engines? Why not keep the trade in this country? The answer to all this is that locomotive building represents a form of investment that may or may not prove remunerative; . . in one word, the lack of power to build locomotives for foreigners is not due to indolence, failure to understand the situation, or ignorance of the facts, but simply to the conviction that money invested in locomotive works could not be made to pay adequate dividends. . . . All the complaints urged against British methods work out in the main to a statement that, as a manufacturing people, we are not sufficiently speculative; we are content with 4 or 5 per cent when we might have had 25 or 50 per cent." This is a flat statement that locomotive building in England is not profitable; if it is correct we cannot understand why such strenuous objection should be made to other people building them, and why English and colonial railway managers in all the ends of the earth are bitterly upbraided for sending orders to us.

THE TELEPHERAGE SYSTEM OF TRANSPORTATION.

Although the aerial cable or rope tramway system of transportation is old, and well recognized as one of the standard methods of transferring freight, the recent modification which is shown in the accompanying illustration is distinctly novel and of considerable interest. The ordinary cableway is operated by a rope of fiber or metal, which is attached to the drum of the stationary engine which furnishes the hauling power. The fundamental difference between the old system and the one here shown is that the motor forms

Carrying a Barrel of Liquid.

THE TELEPHERAGE SYSTEM OF TRANSPORTATION.

part of the traveling carriage on which the load is suspended.

As usually constructed, the weight-carrying cable is supported from projecting arms, which are fastened directly to stout wooden or iron poles, the height of the cable above the ground varying from 20 to 50 feet, or more, according to the nature of the buildings or other obstructions which have to be cleared. This supporting cable forms a track for the trolley as in the ordinary cableway; but here the resemblance ceases. Above the cable rope is suspended the feeder wire, as in the ordinary street railway trolley system, the wire being attached to the posts which support the cable and tied in such a way that it is held directly above the cable at a distance of about 18 inches. The trolley wire is itself carried by a supporting wire, from which it is suspended by means of a short wire with insulated fastenings. The traveler or trolley runs upon the main cable by means of a pair of flanged wheels, upon the axles of which are one or more small electric motors which take their current from the feeder wire by means of a trolley bar of the kind shown in the illustrations. From the frame of the traveler depends a stout bar which carries at its lower end a differential pulley hoist, to which the freight which is to be transported is attached and hauled up clear of the ground. The electric controller from the trolley is operated by a couple of wires, which extend from the trolley and are made fast to the chain of the differential pulley hoist. In operation, the freight is hung from the pulley, hoisted to the desired height and started on its trip by a pull on the controller wire. The trolley may be controlled either by motormen, two of whom are usually employed, one at each end of the system, or, if the line is of sufficient length to warrant it, a motorman may be located at intermediate stations. The control from these stations is worked by means of controller wires which extend up the trolley posts to the feeder wire, and the load may be started or stopped from either of these stations, or it may be stopped at any desired position along the line by means of the controller wires already referred to, which are carried by the trolley itself.

The trolley can be operated at various rates of speed, and it is so arranged that, in descending grades and rounding curves, it automatically controls its own speed. When the weight reaches its destination the freight is lowered to the surface by hand.

Mangoes in India.

India is the home of the mango. They seem to grow everywhere in its tropical zone. They are found wild in the jungles and are highly cultivated in gardens and mango groves. The mango of Bombay is especially famous, and is one of the most highly prized of Indian fruits.

The genus belongs to the cashew family, of which we have in the United States a native representative in the "sumac." I believe there are some fourteen species known; some have been completely naturalized in the West Indies and other tropical countries. The most important species is the *Magnifera Indica* or "mango," the Indian native name, of which there are numerous varieties.

The tree is large and spreading, with leathery, lanceolate leaves and large terminal panicles of flowers. The fruit, like the apple of the temperate zone, varies greatly in size, shape, color, and flavor, being sometimes three or more inches long. The largest varieties weigh 2 pounds, but they are usually not larger than a goose egg. The mango is at first green, then becomes partly red or orange color. Beneath the tough skin there is in the better varieties a rich, fleshy, delicious pulp, in the center of which is a large flat stone, to which the inner portion of the pulp is attached by coarse fibers, something after the manner of our clingstone peach. The poorer varieties are smaller in size, tough, and stringy, and are not edible, on account of their strong flavor of turpentine. One writer compares them to "a mixture of tow and turpentine."

The mango season commences in this part of India in May and June, just before the monsoon. The "Alfoos" (or Alphonso) is claimed to be the best variety of the mango. The finest sell in the Bombay markets at the beginning of the season at 4 rupees ($1.30) per dozen, and later drop in price one-half. The other varieties cost according to quality, some as low as 3 annas (6 cents) per dozen; in fact, "jungle mangoes" may be had for even less, but this wild kind is only eaten by the natives.

Inarching is the favorite system of improving the mango by grafting in Bombay.

The wood of the tree, together with sandalwood, is used by the Hindoos for burning. The bark possesses astringent properties, and when cut exudes a resinous and astringent gum. The natives make use of the leaves and leaf stalks in hardening the gum, and the undeveloped fruit (ground into a paste) is claimed to possess vermifugal properties. The seeds when boiled are eaten in times of scarcity of other food.

The fruit is sent from the West Indies in the form of a sweetmeat, but in that state the sweetness has displaced the flavor. The green fruit, pickled and highly spiced, has for some years been exported from India to England. Fresh mangoes, for the first time, have been exported in large numbers from Bombay to London during the present season. It is claimed that they not only reach their destination in fairly good condition, but are fetching fancy prices, being superior to the mangoes from the West Indies. The cast-off wooden boxes used by the Standard Oil Company in shipping case oil to India are utilized in this enterprise. This crude beginning promises to develop into a considerable trade.

I am shipping this week, in a specially made case with plate-glass top, twelve mango grafts of nine different varieties to an enterprising horticulturist at West Palm Beach, Indian River, Florida. This is the second shipment, the first being made at about this time last year, but, on account of the delays attending

Carrying a Workman.

THE TELEPHERAGE SYSTEM OF TRANSPORTATION.

transshipments at London and New York, the grafts were about ten weeks in reaching their destination and were all dead on arrival. It is hoped better success will follow this consignment.

Almost all the fruits of the Old World are said to be improved by being transplanted in American soil. If the Bombay Alfoos mango can be thus improved, we shall have found a delicious fruit.—Wm. Thos. Fee, Consul at Bombay.

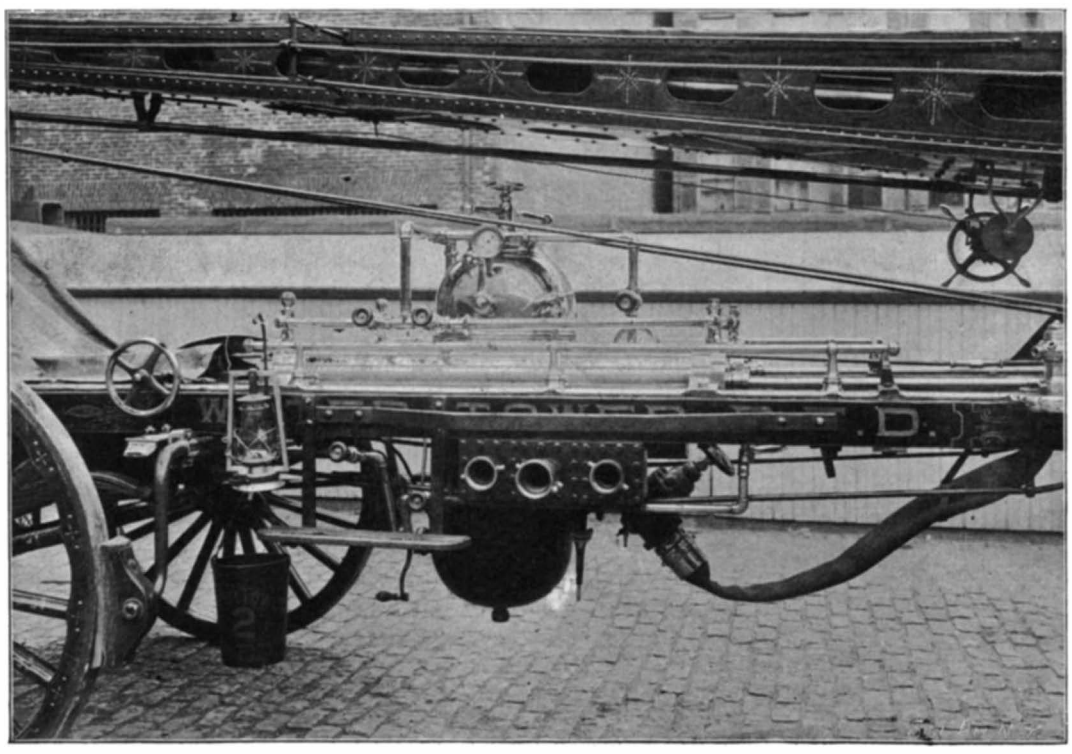
A FIRE DEPARTMENT DRILL SCHOOL.

BY WALDON FAWCETT.

Even with the present keen rivalry among the fire departments of the leading American cities in the maintenance of drill classes designed to afford instruction in every branch of fire fighting and the saving of human life at fires, the Boston Fire Department Drill School ranks as an exceptionally interesting institution, and one wherein the training is as thorough as it well may be.

Every pupil in the school during his attendance goes through all the maneuvers necessary to the handling of the various pieces of machinery, ladders, etc., now used by modern departments for subduing all manner of fires under all possible conditions. This training does not, of course, include instruction in the management of steam fire engines, a class of duties for which a special branch of schooling has been provided.

Every new member of the Boston department must attend this school for a period of thirty days, at the expiration of which time he is, if he proves satisfactory, placed "on probation" for six months. During this half year interval the recruit is in reality a regular member in all his duties and virtually is merely waiting for time to advance to the higher positions. About 5 per cent of the men who enter the drill school never get into the department. They come to a realization, of their own accord usually, that they are not suited to the work, and thus it is only on rare occasions that the instructor is obliged



WATER TOWER USED IN PRACTICE BY FIREMEN.

to inform any candidate that his work is below the standard. Admittedly every unqualified person kept off the rolls benefits the general efficiency of the department just as unmistakably as does added detail in the training of the eligible recruits.

The course of instruction at Boston includes practical work with all kinds of play pipes, cellar pipes, nozzles, extinguishers, hose-hoists, two, three, and four-way connections and the innumerable small accessories employed in the most up-to-date practice. The students are compelled to put all these in turn into actual service; and, in consequence, when the prescribed period has expired, the novice is such no longer, but a thoroughly competent member, having every detail fresh in his mind and awaiting only actual experience at fires to complete his knowledge.

As in all the most progressive schools in this country extended attention is given to the subject of life-saving at fires and instruction in the uses of all the devices employed where human life is imperiled. One of the first pieces which the novice has to handle is the Pompier ladder, and he is taught that there is more of a knack in managing this single hardwood stick than would be imagined, since the top end carries most of the weight and has to be balanced carefully at all times or it will topple over and get beyond the control of the fireman and fall to the ground.

Instruction is also given in one of the most valuable uses to which the Pompier can be put, namely, its employment supplementary to an extension ladder. When the ladder proves too short by one, two or three stories it is often possible for a couple of men to run up and piece it out, with a scaling ladder, thus obviating a delay which might prove very disastrous. That portion of the work which is the supreme test of a man's nerve, the surmounting of the coping, when the man is in reality climbing up the under side of the ladder with the Pompier swinging clear of the wall, is not attempted until the recruits have been very thoroughly coached and have proven conclusively an ability to preserve clear-headedness under trying circumstances. Of course the "chain-building" with scaling ladders is an important branch of the work and the men are kept at it until each crew can maintain an almost continuous upward movement and reach a roof quicker than any extension ladder.

The various styles of aerial ladders are explained and every man is made familiar with the working parts. For this purpose one of the regular companies of the department is sent to the drill yard and the new men receive practical instructions. The life gun is another feature of the equipment, the use of which is taught to the men, a very wise precautionary measure, since every ladder truck in the city of Boston now carries one of these handy life savers, and a man may be called upon to use the weapon at any time.

Among the larger pieces in the use of which the school is drilled is the Haile water-tower. This is a most valuable piece of apparatus for use in operations against lofty buildings. It consists of a telescoping stand-pipe, capable of raising to a height of 65 feet and carrying a large line (4-inch) of hose up through the center, in such a manner that a horizontal stream of great force and capacity may be directed through the windows and, entering straight as it does, penetrate to the farthest corners of the building. The tower is raised by means of chemical pressure generated in a special tank for the purpose and acting through two long cylinders on the frame. The extension, or tip, is wound up much the same as on the large ladders.

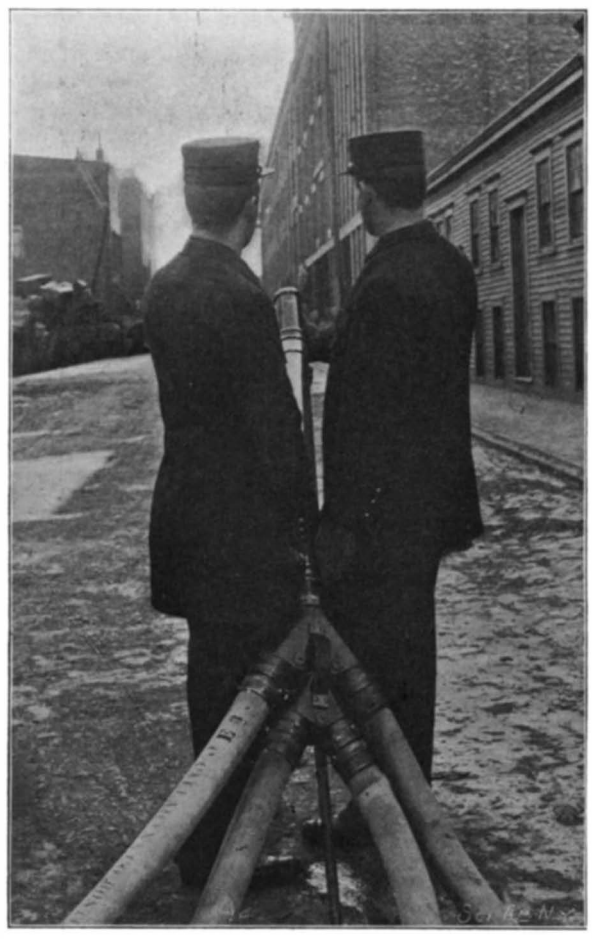
The value of the jumping net as a life-saver is most highly estimated in the Boston department, and every man in the training school is instructed not only to properly hold it, but as to the most approved manner of jumping into it from various heights ranging up to 30 feet. After a few trials it is an easy matter to land in a sitting posture, the proper way, and it has been proven at the Boston school that a man can jump into the net from a height of 50 feet and suffer no inconvenience. However, 30 feet is the limit required by the instructor.

BOSTON FIRE-DRILL SCHOOL—FIREMEN READY TO PERFORM EVOLUTIONS.

Conditions in the Philippine Islands.

Conditions in the Philippine Islands as seen through British eyes are pictured in a report of the British Consul at Manila, which has just reached the Treasury Bureau of Statistics. It says:

"The gigantic nature of the task before the United States authorities in these islands is probably not understood in the United Kingdom. The group has an area of 114,000 square miles (about four-fifths of that



FOUR-WAY CONNECTION ATTACHED TO NOZZLE.

of the United Kingdom). The islands are very scattered, the extreme north and south being about 2,000 miles apart. They are about 600 in number, though only 11 are of any size or importance.

"The population is variously estimated at from 8,000,000 to 10,000,000.

"To reduce this huge tract of land and water to subjection the Americans have at the time of writing some 60,000 troops and a small naval force. The smallness of the latter and the lack of light draught vessels make it very hard to watch the coasts of the islands, and the natives on being driven from one are able to escape to another and recommence operations. The natives are in great measure badly armed and unskilled in the use of firearms, but are sufficiently well led to avoid general engagements, and confine themselves to attacks on the lines of communication. At the same time they have a system of secret agents all over the archipelago who manage in various ways to collect funds for their war chest, Manila itself, as recent arrests have shown, being their best hunting ground.

The configuration of the islands is very much in favor of the guerilla warfare carried on by the natives. Steep, volcanic ranges, large swamps and forests, along with a deficiency of roads, all tend to make the movement of troops and supplies difficult. The climate, too, especially in the rainy season, is trying. In spite of the above difficulties the United States troops have made great progress. Posts have been established all over the islands, from which the troops make constant expeditions against any considerable force of natives coming together in their neighborhood, with the result of a very large and constantly increasing total of killed and wounded on the native side at small cost to the American forces. Owing, however, to the fact that the peaceful cultivator of one day can by digging up his weapons become the truculent bandit of the next, traveling is not encouraged. The deportation of leading rebels to Guam, one of the Ladrone Islands, and especially of the Manila contingent, who although not actually in arms were directing and financing operations, has had a very salutary effect, especially as deportation was coupled with confiscation of property.

"A 'Federal' party has been formed to propagate pro-American opinions among the natives, in which the native judges and other officials are taking a leading part. Native provincial governments are in course of organization in the more pacified districts. Whether they will be a success or not is problematical. American schools are being established all over the islands, the staffs of which are brought over from the United States.

"Prices continue high, especially rent. Few new houses have been built, and the influx of American officials and their families still continues. The result of this is that the most ordinary style of house becomes an object of keen competition, and rents have been in many cases quadrupled in the past three years. The average rent of a small house in the suburbs suitable for four or five persons is now about £20 ($97) per month.

"There are no openings for Europeans here except with capital, the number of destitute and unemployed Europeans and Americans being constantly on the increase. There is no difficulty in filling up posts of any sort from the American volunteers now being disbanded here in large numbers, many of them being men of superior education.

"British interests in the Philippines are much larger than currently supposed at home. There are about twenty British firms in Manila. Their importance will, perhaps, be best gaged by the fact that two out of the three banking establishments in the city are branches of well-known British corporations. They include the largest import and export firms, but engineering works, ship repairing, stevedoring and many other industries are also represented. The larger firms have branches in most of the provincial ports as well as rice and sugar mills up country. The only railway in the Philippines, that from Manila to Dagupan, the port of the rice-producing district of the island, is the property of a British company, and many undertakings with foreign names are carried on mainly by British capital and energy. Taking into account the numerous insurance, shipping and other firms for which local firms are agents, it will be evident that British interests in the Philippines run into millions.

"Trade in the year 1900 has been at a comparative standstill. In the early part of the year, owing to the general anticipation of a speedy pacification and subsequent boom in trade, large imports were made by the various firms in the islands. The coun-

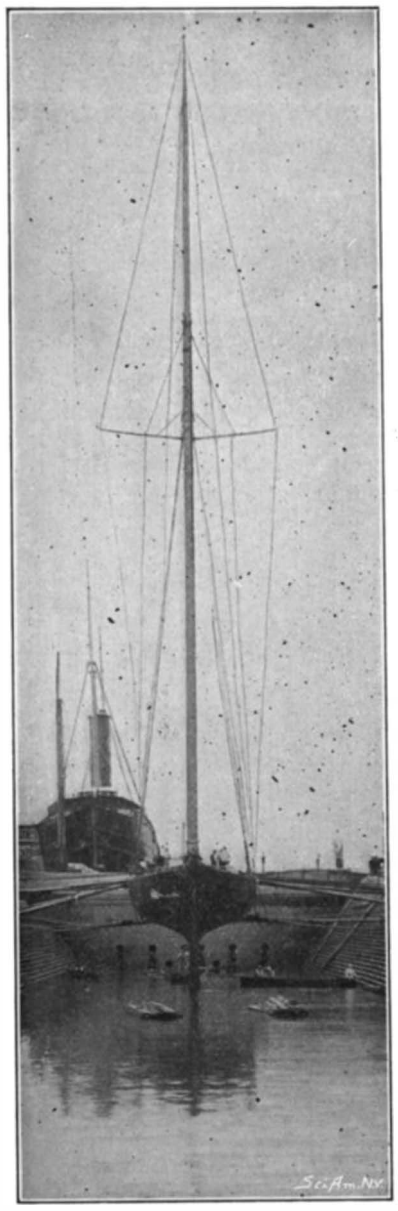
try still continues disturbed, rendering retail trade impossible, with the result that all importers have large stocks on hand. Exports are suffering from the continuance of warlike operations. Owing to the insecurity of life in many sugar-producing districts, owners of properties have not in many instances been able to visit their estates and, therefore, plant crops, the consequence being that in this and the Visayas districts the arrivals of sugar are trifling compared with those of past years."

THE ELEVENTH CHALLENGER FOR THE AMERICA CUP—"SHAMROCK II."

When the under-water form of "Shamrock II." was laid bare in the Erie drydock, two facts were at once made evident: First, that G. L. Watson has designed an entirely original boat; second, that the much-talked-of towing experiment in the Denny testing tank were evidently responsible for the most striking departures in her lines from what might be called the orthodox form of a 90-foot racing cutter. It may further be stated, without much fear of contradiction, that with the exception of a certain fullness in the sections from about the wake of the mast forward for several feet into the overhang, she has the most refined form ever seen in a Cup challenger, not even excluding that beautiful creation of the Herreshoffs, "Columbia." Her afterbody, from the point of greatest beam, which lies not very far aft of the shrouds, to her narrow and shallow stem, has been refined to a degree which makes one ask how it can ever be possible for the boat to carry her great spread of 14,500 square feet of canvas; particularly as the peak of her club-topsail will be 175 feet above the waterline. Yet, carry it she does, and shows a stiffness, moreover, that is greater, if anything, than that of her predecessor "Shamrock I."

The accompanying end-on view of the yacht, which was taken from a point about 300 feet distant, and slightly below the level of her water-line, conveys a closely approximate idea of her midship section. It will be seen that Watson has returned somewhat to the midsection which distinguished his two most successful boats, "Queen Mab" and "Britannia." There is not the slightest suggestion of the high bilges of the scow form, as seen in "Independence," nor is there the compartive hardening of the bilges, as seen in "Columbia," and even more markedly in the Herreshoff 70-footers of last season. So easy, indeed, are the bilges that we have to go back to "Defender" to find their like, and they round into the broad sweep of the freeboard curve at the fin with a true reverse curve, without so much as a suggestion of a straight line in the floor. These features, taken with the rather full and round sections toward the bow, the finely-drawn-out run and quarters, and the easy curve and great length of the diagonals, point toward a form that will be easy to drive at the higher speeds, and will show but little of that wave-making tendency which was a marked fault in "Valkyrie III." and "Shamrock I." The model is distinctly original, and, as we have said, bears upon it the mark of the towing-tank. We venture to say that the model of the boat will commend itself at the very first glance to any naval constructor who may chance to see the "Shamrock" in drydock.

While the body of the boat would suggest great speed in fresh winds, particularly in running and reaching, we think that she will not prove to be relatively so speedy in light airs. It is surprising to find that the lateral plane shows an area of fin that is at least as large as that of "Shamrock I." Watson and Fife are reported to have collaborated in the production of this yacht, and so striking is the likeness in depth and length of fin, and in shape of bulb, that one could almost believe, were it not for the utter dissimilarity of the body above, that one was looking once more at "Shamrock I." In view of the splendid weatherly qualities of "Columbia," whose keel is several feet shorter, one would have expected Watson to have reduced his lateral plane, and so saved some 80 to 90 square feet of wetted surface. Of course, a long keel means a low center of gravity of the lead, with a proportionate increase in sail-carrying power; and the good results are seen in the ease with which "Shamrock II." carries her club-topsail in a fresh breeze. In lighter winds area of wetted surface becomes a factor of greater importance than ease of form, and in winds of 8 knots' strength and less we look for "Shamrock II." to show to less advantage. The dimensions of the hull are: Length on deck, 137 feet; beam, 24 feet; draught, 21 feet 3 inches.



End-on View of Shamrock II. Showing Midship Section and Lofty Rig.

The sail-plan of the new challenger is relatively narrow in proportion to its height. The steel pole mast of the "Shamrock" measures 158 feet, 8 inches over all, and buries 8 feet 8 inches in the hull, thus making the height from deck to truck 150 feet. As the club-topsail extends 20 feet above the truck the peak of that sail will be 175 feet above the water-line; and if the yacht were ranged alongside the Brooklyn Bridge its club-topsail would extend 40 feet above the roadway! Compared with its height the sail-plan will have a comparatively narrow base, the boom being exactly 102 feet 9 inches long, and the bowsprit 30 feet outboard.

Compared with "Shamrock I." the new yacht has a foot less beam, a few inches less draught, less displacement, less wetted surface, and over 10 per cent more sail area. She is also lighter in construction. In her earlier trials against the older boat she failed to show any marked superiority; but in her later trials she seems to have "found herself," and has beaten the Fife cutter under any conditions of wind and sea.

A NEW LUMINOUS FOUNTAIN.

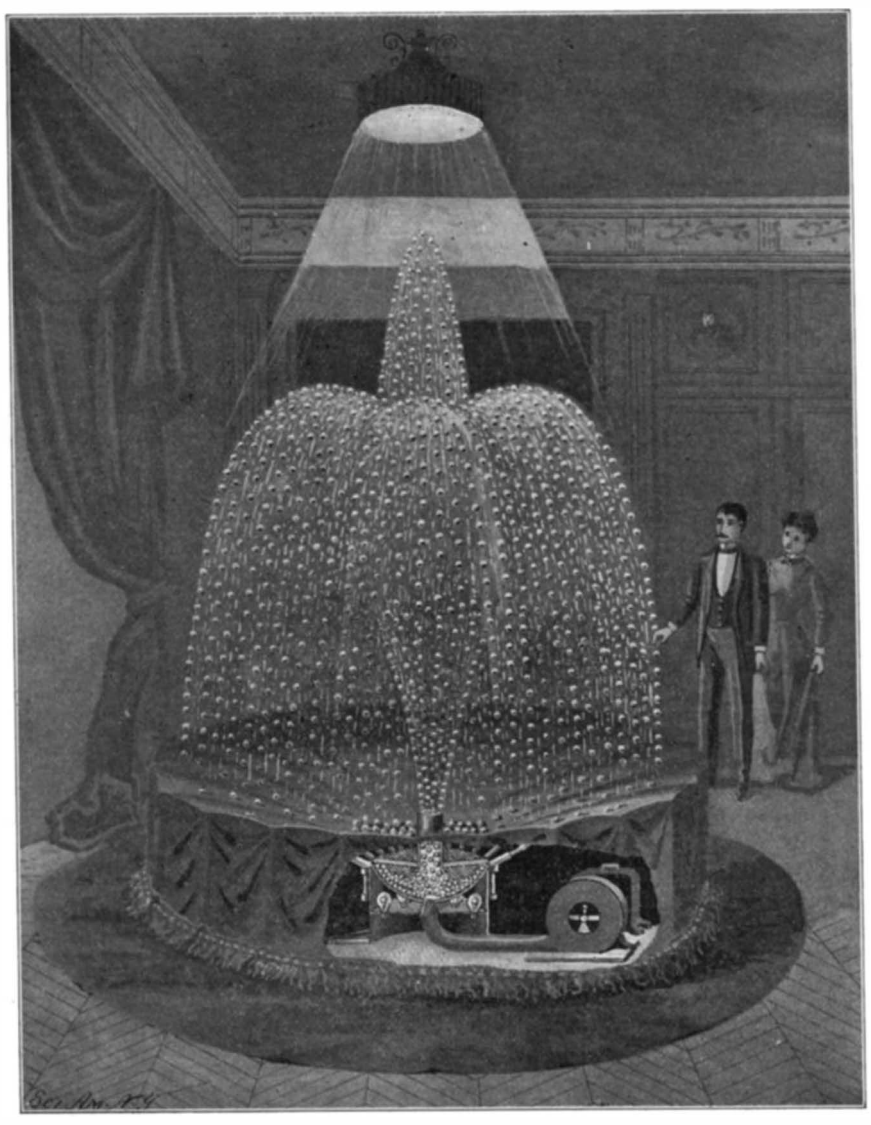
A recent number of the Transactions of the French Academy of Sciences describes a very ingenious luminous fountain which owes its invention to Gustave Trouvé. Luminous fountains have been not the least attractive feature at every international exposition held since 1889. In a few public parks of American cities and in certain places of amusement abroad such fountains have been permanently installed. But it is safe to say that the great majority of people have never seen a luminous fountain. It is for these less fortunate ones that M. Trouvé has devised a portable apparatus which can be set up in a house and made to spurt streams of light which seem like luminous water.

In order to overcome the difficulty of installing a system of water-pipes—a difficulty which has hitherto prevented the general introduction of luminous fountains—Trouvé decided to dispense with water altogether and to secure the effect of falling drops by means of grains of wheat, barley and rice and by means of small balls of colored celluloid. The rice and the celluloid proved most effective.

In its general construction the apparatus includes a sheet-metal cylinder, the raised bottom of which is provided with a number of incandescent electric lamps. Through an opening in the center of this bottom a blow-pipe extends. Within the upper portion of the cylinder a receptacle is supported communicating with the blow-pipe and resembling in form an inverted mushroom, the stem of which constitutes a chimney-like passage for the escape of the wheat grains or celluloid balls contained in the receptacle. When air is forced through the pipe the grains or balls are blown up through the hollow stem to a considerable height, only to fall back again into the receptacle.

In order to impart to the contrivance the appearance of a fountain the cylinder is provided with radiating bamboo rods, upon which a green fabric, properly draped, is hung. This artificial basin can be adjusted at any angle to the cylinder and serves the purpose of receiving the balls blown through the central stem or nozzle, so that they may roll back to the receptacle in order to be discharged again.

Light is thrown down upon the fountain by incandescent lamps mounted in a reflector secured to the ceiling. The polychrome effect produced by the beams reflected by the balls is exceedingly picturesque and decidedly illusory.



A NEW LUMINOUS FOUNTAIN.

A New Rangefinder.

A new rangefinder, invented by Prof. G. Forbes, F.R.S., was on view at the Bisley rifle meeting, says Nature. The want of a rangefinder that is portable and workable, that has not more than 2 per cent inaccuracy at 3,000 yards, and that does not require a telescope so large as to require a stand, is much felt in infantry work, especially with maxims. All these conditions, says The Times correspondent at the meeting, are met by the one in question. It consists of an aluminium base, 6 feet in length, which can be folded in the middle and strapped across the back, and a field-glass carried in the usual fashion. The base is a square tube, hinged at the middle. Each half has at each end a doubly-reflecting glass prism. The rays of light from a distant object strike the outer pair of these four prisms, are reflected at right angles along each tube, and are then reflected at the two middle prisms into the two telescopes of the binocular, which can be easily fixed to the center of the base when in use in directions parallel to the original rays intercepted by the outer prisms. By the measurement of the angle between these rays the distance of the object looked at is determined. This angle is measured by two vertical wires, one in each telescope, seen by the two eyes. One of these wires is fixed, the other moved by a micrometer screw until the two wires appear as one at the same time that the object is seen distinctly. The instrument gives the distance, in the hands of an ordinary observer, at 3,000 yards to within 60 yards, at 1,500 yards to 15 yards. The 6-foot base folds to 3 feet 3 inches, and weighs under 3 pounds.

Yellow Glass for Fixed Signals.

The use of yellow glass for the lamps of fixed signals is steadily increasing, says The Railroad Gazette. The latest installation is on the joint line of the Erie and the "Big Four," between Marion Junction and Gallion; and this example will be of particular interest because the yellow lights will be used under more trying conditions than they have been subjected to anywhere else. Doubt has been expressed on all sides whether a yellow which is dark enough to be quickly

distinguished from street and house lights would not under adverse conditions, such as a foggy atmosphere, be likely to be mistaken for red, and thus lead to confusion. It has been claimed that an engineman who should often find it difficult to decide whether or not a light was red would become careless and would put all reds and yellows in the same class; and thus would sometimes run past a stop signal, taking it for a home signal.

VULNERABILITY OF THE SUPERPOSED TURRET.

In a supplementary report of the Naval Board on Construction, of which Rear-Admiral O'Neil is president, extended reference is made to the weakness of the superposed turret looked at from the point of view of defense. The report contains a diagram of the "record practice" target made by the British cruiser "Terrible" plotted on a projection of the end-on view of the superposed turrets. There can be no question, the report says, that the placing of the 8-inch turret on top of the 13-inch turret considerably increases the danger of disablement of the 13-inch turret and also of the 8-inch turret itself. This is very conclusively shown in the following extract from a report on the protection of gun positions, wherein a comparison is made between certain foreign and our own battleships of the "Kentucky" class, by a well-informed officer of the navy. In regard to the chances of total disablement from either an internal accident or a small shell entering the port opening, he says:

"A baseball tossed into one of the ports would fall directly into the 13-inch handling room, opening into which are the 13-inch magazines, and below which are some of the 8-inch magazines. In action, at least four charges would be exposed, either in the ammunition hoists or ready to be put into them. There can therefore be no reasonable doubt that the explosion of a large or even medium caliber shell in the 13-inch turret would not only inevitably destroy the guns' crews and put the entire system out of action, but would, in all probability, explode the 13-inch and 8-inch magazines, as well as the 5-inch main magazines that are immediately adjacent to them, thus entailing the complete destruction of the vessel."

With reference to the additional danger of disablement of each turret, due to the fact of their superposition, he says:

"I have appended a sketch showing a projection of the end-on view of the superimposed turrets against a British 'record practice' target; and on the latter I have plotted the actual record made by H. M. S. 'Terrible' in 1900. * * * The target, therefore, represents the fire of the guns on one side; that is, six 6-inch guns during four minutes. * * * The 'Terrible's' record showed 104 shots and 80 hits with the 6-inch guns on the regular target (16 by 20 feet). Seventy-nine of the 80 hits would have struck one or the other of the 'Kentucky's' turrets. * * * Twenty-six and six-tenths per cent are on the 8-inch turret. As these shots would have passed over a single turret and been wasted, it is clear that the 8-inch turret, in this position, acts as a 'save all' for line shots going too high, and that consequently its chances of being hit are much greater than if it stood by itself. * * * Projecting the 'Canopus' ' turret or shield against the target, it will be seen that it would have received 36 per cent of the 79 shots, or 45.5 per cent, thus illustrating the relative value of the low target."

The experience gained with the double turrets on the "Kearsarge" and "Kentucky" has been sufficient, says the report, to show that the features of the design, so far as they relate to the mechanical means of operation, are successful; but the features of the design, so far as they relate to the efficiency of the superposed turret as a weapon of offense, have not been developed by any practical tests. The guns have been fired at target practice in various ways, some defects in the gun mountings have been developed and remedied, but no serious test of the four-gun turret, to compare its efficiency with the two-gun or one-gun turret, has ever been made.

It is clear, from the line of argument adopted in the beginning of this statement, that it is perfectly practicable to make a test of the turrets of the "Kearsarge" and "Kentucky," which would determine the efficiency per gun from actual trial.

The general outline of the tests would be as follows:

A large target should be used, say 60 feet long at the bottom, 20 feet high, and 30 feet long at the top. This target should be anchored and moored with its length parallel to the course which the ship shall take. The firing should take place at ranges varying from about 2,500 to 1,500 yards, with the vessel moving from 6 to 8 knots per hour, and extend over a length of time of not less than twenty minutes. The "Kearsarge" should make the following runs over the course:

(1) Firing the starboard 13-inch gun of the forward turret.

(2) Firing both 13-inch guns of the forward turret.

(3) Firing all four guns of the forward turret.

The "Alabama" should make the following runs:

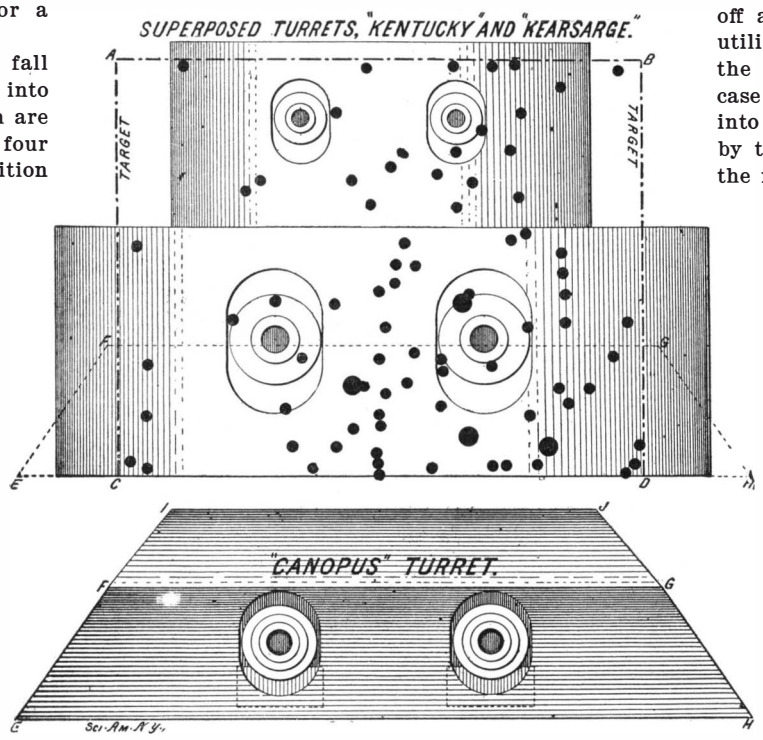
(1) Firing one 13-inch gun of the forward turret.

(2) Firing both 13-inch guns of the forward turret.

The "Brooklyn" should make runs similar to those of the "Alabama," firing the 8-inch guns of the forward turret.

NOTE.—Actual hits only to count.

These tests certainly should be made, and the results would be required to show a very high order of efficiency in powers of offense to justify the adoption of a device which has such transparent defects in defense.



A B C D, Record Target, area	320	square feet.
E F G H, "Canopus" Turret, area	122.5	" "
F I J G, Sloping Roof, area	55.5	" "
Superimposed Turrets, area	352	" "
Number 6-inch shots fired	104	
Number of hits on Record Target	80	
Number of hits on Superimposed Turrets	79	
Number of hits on 13-inch turrets—73.4 per cent	58	
Number of hits on 8-inch turret—26.6 per cent	21	
Number of hits on "Canopus" turret, front—45.4 per cent	36	

The above target represents the firing of:

Six 6-inch guns firing during	4 minutes.
Two 9.2-inch guns firing during	6 "

RECORD PRACTICE OF CRUISER "TERRIBLE," PLOTTED OVER SUPERPOSED TURRETS.

A New Weaving and Dyeing Process.

A German engineer, Otto Hallensleben, has recently invented a most interesting weaving and dyeing process, which gives promise of making a revolution in those industries. The new process practically gives a monopoly in the manufacture of carpets and rugs of the Oriental type and of similar tufted and pile fabrics. The new method has been established on a commercial scale, and for our description we are indebted to Fielden's Magazine.

In the old process, which dates from 1839, the color is placed upon the yarns after they have been wound in position, side by side upon drums. The drums are provided with a collapsible section, and on their periphery an index is marked off in spaces equal to the width of the surface of the pile or loops required in the finished fabric. One end of the frame in which the drums are mounted can be lowered or taken away from the central shaft. Beneath the drums is a tramway on which a truck or carriage is run which contains a vessel holding one of the coloring mixtures required for printing or coloring a section of the yarn, according to the design or pattern which it is intended to reproduce. When the truck passes under the drum, the pulley revolving in the color mixture impinges against the yarn and colors the portion of the surface marked off by the index. This process is repeated, the truck passing backward and forward and the drums turning so as to expose the portion to be printed in each case, while the coloring receptacles containing various colors are substituted, one for the other, until the whole surface of the yarn has been treated. Gum or starch is necessary to cause the colors to adhere, and in order to make the color penetrate the yarn and to remove the excess, the labor of two assistants is required to operate the scrapers. The excess color is entirely wasted. The collapsible drum permits of the yarn being placed on a temporary carrier and it is then conveyed to a steamer which sets the colors. It is then washed and dried and is ready for the loom. The process, while a great advance on the older ones, requires a great amount of labor and a considerable number of operators. The process is wasteful and to some degree inaccurate.

All these drawbacks are entirely removed by the new process. In general construction and action the coloring apparatus resembles a slide lathe with its compound sliding rest. The printing or coloring trucks are operated automatically, traversing the whole length of the printing bed, backward and forward without stopping, unless checked to permit the printing of the various sections of the yarns staked off in conformity with the patterns which it is intended to reproduce in the fabric. For the checking of the trucks the Jacquard apparatus is used, the needles of which are put in action by a card coming in contact with them whenever the distance allotted for their journey is completed, in stopping them after they have traveled the width of one loop, two loops, etc., as required by the design. Thus, for instance, if the design requires that a certain color shall be impinged on section number 2, of the white yarn, or section number 20 for printing the second loop, or on section number 40 for the third loop, the card will be stamped accordingly and the truck carrying the color will be checked at the places indicated, to enable the printing to be done by means of an automatic device placing a pair of jaws in contact with the portion of the yarn that is to receive the special color, and the operation is performed by one or more small color pulleys, the number varying according to the class of yarn used for the fabric in the course of manufacture, whereby an ingenious combination of mechanical devices the exact amount of color required is previously measured off so as to prevent all waste. On the other hand, the amount measured off and held between the top and bottom pulleys is utilized to the fullest extent, and not impinging on the surface of the yarn merely, as is clearly the case in the ordinary presses, but is thoroughly rubbed into the yarn by these pulleys, which are actuated by the jaws accompanying a reciprocating motion by the mechanism referred to. Section number 2 having been treated in this way, the truck recommences its journey until section number 20 is reached, when it is stopped in order that the process may be repeated, and so on until the whole yarn is colored and ready for the operation of setting the colors. Any number of colors may be applied simultaneously by employing a corresponding number of printing trucks. Without interruption the process continues by bringing into action a device which automatically transfers the multi-colored yarn on a truck, conveying it to a steam tube 9 inches in diameter, having its opening directly opposite the coloring machines; and the moment the truck is admitted the door of the tube closes, steam enters the tube and the setting operation takes place in about a quarter the customary time. The process is a continuous one, the coloring and printing operations being duplicated, so that the second quantity of yarn is prepared for printing while the first quantity is being printed and steamed. The two sections of the machine are alternately used. The washing of the yarn is also automatically performed by special mechanism.

Mr. Hallensleben's other textile invention is a loom of the type known as double-fabric loom, by which two connected pieces of pile fabric are woven simultaneously and by one operation, being separated as the weaving proceeds by severing them in the center. Its weight is over 10 tons. It is 35 feet in width by 10 feet in depth and 8 feet high. The work that is being done on it at present is the weaving of a Turkish fabric 10 feet in width. Looms of greater diameter and of the same construction can be built to manufacture fabrics 30 feet wide.

The Current Supplement.

The current SUPPLEMENT, No. 1338, is begun by an interesting article upon the "Georgia School of Technology" accompanied by 10 engravings, showing the students weaving, dyeing, etc. "Enameling at Paris" is an important technical article. "The Clarke Automatic Coaling and Weighing Barge" is accompanied by a number of engravings, showing in detail how the work is performed. "Amplification of Weather Forecasts" is by Prof. Alfred J. Henry, and is illustrated by four engravings. "The Sculptures of Santa Lucia Cozumahualpa, Guatemala, in the Hamburg Ethnological Museum," is a very interesting archæological article. "Some Recent Advances in General Geology" is an important paper. "The Mercadier Telegraph" is accompanied by many diagrams. "American Locomotives in England.—II." is published in this issue.

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

TELEGRAPH-RELAY.—JULIO E. CORDOVEZ, Panama, U. S. of Colombia. The invention provides an efficient and sensitive construction for repeating telegraph messages both with and without the use of sounders or other receivers at the intermediate stations, and allows the use of the apparatus either for repeating purposes or for those of ordinary communication from station to station. The use of springs or like delicate and rather uncertain devices is avoided.

Engineering Improvements.

ROTARY ENGINE.—FREDERICK S. PICKERING, Olathe, Kans. The inventor has devised an improved engine, the characteristic features of which are to be found in a cylinder having a central core spaced from the wall of the cylinder to form an annular working-chamber. The piston has a number of piston-heads traveling in this working-chamber. A revoluble abutment extends into the annular chamber, the abutment having a cut-out portion for the passage of the piston-heads. Peripheral seats for this abutment are formed by a recess in the inner surface of the cylinder and the recess in the core, the core being provided at this recess with a packing forming part of the seat. The peripheral surface of the abutment contacts closely with its seats in the recesses, thereby forming a closed working-chamber and a perfect abutment for the back pressure of the steam. The core-packing is subjected to steam pressure for counterbalancing purposes. Springs engage the core-packing and act in conjunction with the steam pressure to insure a constant excess of pressure in the direction of the abutment and constant contact therewith.

Machines and Their Accessories.

BELT-PLACER.—JORDAN S. MONTGOMERY, FELIX G. OWEN and ROBERT R. OWEN, JR., of Franklin, Ky. The object of the invention is to provide a simple device especially adapted for the placing of long, heavy, horizontally-running belts, such as a belt for a threshing-machine or the like driven from an engine. The device comprises a segmental plate gradually diminishing in width from one end to the other and provided with an upwardly projecting flange on its upper end. The plate is secured to an arm which is provided with a hub adapted loosely to fit upon the end of a pulley-shaft. The arm is detachably secured to the pulley. On turning the pulley, the band will first engage with the wider portion of the segmental plate, and as the pulley rotates the flange will force the belt over and upon the pulley.

SAWING-MACHINE.—CHARLES SEYMOUR, Defiance, Ohio. To its long list of woodworking machines the Defiance Machine Works has added an improved sawing-machine which is designed for sawing off at one operation both ends of a spoke, handle, neck-yoke, singletree-blank, or other articles which are to be made of the same length. The machine is readily adjustable for any length of work required. Broadly, the machine has circular saws for sawing off the work; an endless carrier for feeding the work to the saws; swing-arms, resting on the work while the saws cut off the ends of the work; and a friction drive-gear for the endless carrier, controlled from one of the arms.

Railway Devices.

MAIL-BAG HOLDER.—ALEXANDER M. HARRIOTT, Rye, N. Y. Hitherto great difficulty has been experienced in providing a device which will hold the bag securely under ordinary conditions, and yet quickly and effectively release it when the bag is engaged by the catcher or fork of the railway train without breaking the rings. The present invention provides a device which will hold the bag securely under all conditions, except when strain is placed sidewise on the bag, and then the bag will be quickly released so that it can be carried away by the train.

SWITCH-OPERATING MECHANISM.—FRED A. CARROLL, Penn Yan, N. Y. The mechanism is designed to be carried by a street-car for operating railway switch-tongues and also for operating a connection between switch-tongues. The device which forms the subject of this invention can be easily operated by a motorman on the car-platform. A rod is vertically movable through the car-platform and is held in its axially-adjusted position. Springs take the thrust of the rod in opposite directions. A shoe is carried on the lower end of the rod; and the switch-tongue is operated by the shoe.

RAILROAD-TRACK.—JACKSON, LIEB and COMPANY, Citizen's Bank, Anderson, Ind. The tendency of tracks to spread on curves on account of the extraordinary strain exerted against the inner side of the outer rail by trains is well known. The present invention seeks to provide a simple construction by which the outer rail is securely anchored. The application of this structural method to railway curves will also tend to diminish the rotting of the rail by the accumulation of moisture.

Household Utensils.

WINDOW-CLEANER.—THOMAS MART, Brooklyn, New York city. By means of this simple device a person can simultaneously clean and polish both the inner and outer surfaces of the window-pane. The utensil consists of two arms connected by a spring at one end and provided with head-blocks which receive polishing-cloths. The window is received between these padded blocks, and is polished on both sides at the same time.

AUXILIARY POT-HANDLE.—EMIL MEYER, Jersey City, N. J. The object of the invention is to provide a new and improved auxiliary pot-handle which is simple and durable in construction and which is readily applied to a kettle to permit one conveniently to move the kettle about or to turn it over and pour off the liquid contents without disturbing the solid matter.

Architectural Improvements.

CONSTRUCTION OF FLOORS, PARTITIONS, OR THE LIKE.—VALENTINE MOESLEIN, Manhattan, New York city. By means of this construction a floor, partition or the like can be cheaply built and rendered perfectly fireproof. The construction comprises spaced supporting arms and metal laths extending transversely from one arm to the other. These laths have laterally-offset recessed portions passing around the supporting arms and securing the laths thereto. The recessed portions hold the major portion of the laths at one side of the supporting arms opposite the side embraced by the recessed portion.

ADJUSTABLE DOOR-FRAME.—JOHN BACHUS, Jersey City, N. J. This adjustable door frame is arranged to permit convenient adjustment of the rabbet-strip at any time to insure proper opening and closing of the door without requiring planing or rechanging of the door as has been so frequently practised hitherto to overcome the defects caused by swelling, shrinking, warping and settling.

Apparatus for Special Purposes.

APPARATUS FOR REGENERATING AND PURIFYING AIR.—ALEXANDRE DESGREZ and VICTOR BALTHAZARD, Rue Saint Jacques 240, Paris, France. The apparatus decomposes sodium bioxid or any other alkaline bioxid by cold water, with the object of producing oxygen and soda, with which vitiated air is placed in contact. The oxygen renews that which has been used in respiration, and the soda absorbs or fixes the carbon dioxid expired. In addition, the foul air and toxic material produced by respiration are destroyed by this reaction, which is of an oxidizing character. The apparatus consists essentially of an automatic means for distributing sodium bioxid; a generator in which water is made to react upon the sodium bioxid; and a fan which causes the circulation of air in the apparatus.

MEANS FOR COOLING CALENDER-ROLLS.—GEORGE F. DREW, Brunswick, and CHARLES DICKINSON, Lisbon Falls, Me. The invention is an improvement in devices for supplying air to the surfaces of calender-rolls of paper-machines, and avoids the expense of the unnecessary upright pipes and the objections incident to their use. The hollow stands or housings of the calender ring machines are used in supplying the air to the discharge-pipes. The merits of this construction are numerous. No floor-space is occupied, so that the machine-tender may work in a space free and unobstructed.

TIME-INDICATOR.—CHARLES H. BRAKE, Hawarden, Iowa. The invention is a device for indicating the time occurring simultaneously at different points of the globe and for solving problems connected with the change of dates and with the local times of different cities. The device may also be used for solving problems in which it is desired to ascertain where and when a traveler, leaving New York at noon on a journey westward and proceeding so rapidly as to keep the sun in his meridian, will change his date.

Miscellaneous Inventions.

CIGAR CUTTER AND LIGHTER.—CARL A. ROSENHOLZ, Wardner, Idaho. The cigar lighter is of that type in which a wick of an oil or spirit lamp is ignited by an electric spark. The lamp or torch is so connected with the body portion or hood that it can be swung and rotated freely relatively to the body portion or hood. Hence the electric wires cannot be broken. In connection with the lighter, a cigar-tip cutter is provided which is operated by a swinging movement of the torch.

CORNET ATTACHMENT.—CHARLES SPRINGER and GEORGE DAVIS, Newark, N. J. The invention is designed to enable a player to change the pitch from A natural to B flat and vice versa without interrupting the playing of the instrument. The pitch may be changed at will without lengthening or shortening the shank or hub of the instrument. Formerly much inconvenience was occasioned by the substitution of the long and short tubes; but by this invention the change can be made without shifting the position of the mouthpiece.

SAND-POINT.—MILTON LATTA, Burwell, Neb. The invention is an improvement in sand-points for wells and particularly in points that are formed with perforations, a spiral rib extending around the perforated portion, and a wire-cloth strainer being secured upon the rib over the perforated portion. The present invention seeks to furnish an improved construction and arrangement of the wire-cloth with a view to secure a distribution of the strain or pressure upon all the wires of the cloth so that such strain or pressure will be distributed between the wires which cross each other at right angles.

PLANE.—LUDWIG KEMLINE, Pinole, Cal. The handle of the plane may be adjusted transversely so as to place the hand of the carpenter in any desired position relatively to the transverse extent of the plane. By these means the carpenter may avoid bruising his hands.

BELT.—SAMUEL J. PROKESCH, Manhattan, New York city. This improved belt is arranged readily to yield lengthwise and to accommodate itself to the motions of the wearer's body, so as to fit at all times snugly to the waist of the wearer without requiring any adjustment by lengthening or shortening the belt as now commonly practised.

BARREL.—GRANVILLE M. TILGHMAN, West Norfolk, Va. The barrel is intended for use in the shipment of garden truck and the like, in which ventilation is necessary. The broad idea of the invention comprehends a stave for use in barrels, baskets and like packages, which stave is deflected between its ends in the direction of its plane. In making barrels it is difficult to use splints or staves crossing one another diagonally. By this invention this difficulty is overcome.

ACCOUNT-LEDGER.—PAUL K. PAULSEN, Irwin, Iowa. The invention is a perpetual ledger or file, and comprises a tray having a number of slips, and hinged clips which may be swung down over the slips. One slip is provided for each customer. The several items are entered on the customer's slip. When he pays the account the slip is marked "paid" and handed to the customer, thus giving him an itemized receipt of the account and withdrawing his name from the ledger. Hence the ledger is not encumbered by names of customers who have discontinued accounts. The keeping of books is unnecessary. Nothing is overlooked, as sometimes happens when posting is delayed.

MANTLE-SUPPORT.—NELS E. ERICSON, Ridgway, Pa. It is the usual practice to support a burner-mantle by a wire extended from the base of the burner and along one side of the mantle. When the wire becomes heated it bends and causes the mantle to break. Mr. Ericson overcomes this difficulty by providing a simple device that will not be affected by heat. The mantle is supported straight down in the chimney and is at all times free from the glass.

SOAP-CAKE—THOMAS A. LYNCH, 222 Van Buren Street, Brooklyn, New York city. In connection with a cake of soap a plate of rigid material not affected by water is provided and so arranged as to support the soap slightly above the bottom of a soap-dish. Thus the soap is held out of contact with the water that may be on the bottom of the soap-dish or on the stand-top. Soap is thereby saved; for it is well known that when but slightly moistened, soap is slowly dissolved and wasted. The plate may also be provided with pumice stone if it be so desired. The inventor is the proprietor of the "Tom Artlyn" soaps.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

HOLZ UND MARMOR-MALEREI. Praktische Anleitung, zur Herstellung von Holz und Marmor-Imitationen, Imitation eingelegter Arbeiten mittelst Anstrich, übertragen von Drucken auf Holz, Glas, etc. Decoriren von Fensterscheiben u.s.w. für Maler, Anstreicher, Vergolder, Lackirer, Tischler, Drechsler, Decorateure und verwandte Geschäfts-Zweige. Von Louis Edgar Andés. Vienna: A. Hartleben. 1901. Pp. 243.

The present monograph on the decoration of wood and marble is certainly one of the most interesting and valuable which has appeared in the excellent series of technical monographs published by Hartleben. The work is accompanied by admirably colored plates which should be of immense assistance to the beginner in the art of decorating wood and marble. The coloring of these plates is so accurate that it is difficult to go astray.

AMERICAN HANDY-BOOK OF THE BREWING, MALTING AND AUXILIARY TRADES. Chicago: Wall-Henius. 1901. 16mo. Pp. 1,266. Gilt-edge leather. Price $10.

The authors are directors of the Scientific School for Brewing, of Chicago, and of the American Brewing Academy. This is a book of ready reference for persons connected with the brewing, malting, and auxiliary trades, together with tables, formulas, calculations, bibliography and dictionary of technical terms. The authors have done a signal service to all those who are in any way connected with brewing of malt liquours. They have produced a most admirable book which no brewer or any of his chief employes can afford to be without. It is issued in a handy form. It is not possible to give even a list of the chapters, but a special table of contents has been prepared and will be sent by the publishers of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 1210.—For manufacturers of tooth brushes.

TURBINES.—Leffel & Co. Springfield, Ohio, U. S. A.

Inquiry No. 1211.—For parties engaged in sheet metal spinning.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 1212.—For manufacturers of a machine for kiln-drying wheat.

Spring motors. Smith Novelty Co., Hopewell, N. J.

Inquiry No. 1213.—For small portable engine and saw; the engine to be used for pumping, corn shelling, etc.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 1214.—For manufacturers of papier maché goods.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 1215.—For manufacturers of heart bangles for rings.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 1216.—For attractive novelties for window display.

Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

Inquiry No. 1217.—For manufacturers of house lamps or good selling novelties for agents.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 1218.—For manufacturers of soft or virgin rubber tubing.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1219.—For parties engaged in contract work on wire heading machines.

For Sheet Brass Stamping and small Castings, write Badger Brass Mfg. Co., Kenosha, Wis.

Inquiry No. 1220.—For manufacturers of natural stone for filtering water.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1221.—For manufacturers of portable shelving for shoe and dry goods stores.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 1222.—For a steam oven for a small bread-baking plant, wood to be used for fuel.

SAWMILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 1223.—For parties to manufacture in quantities a small metal collar and tie retainer.

WANTED.—Punch and die work, press work and light manuf'g. Daugherty Novelty Works, Kittanning, Pa.

Inquiry No. 1224.—For manufacturers of machines for making buttons from shells, etc.

Automobiles built to drawings and special work done promptly. The Garvin Machine Co., 149 Varick, cor. Spring Streets, New York.

Inquiry No. 1225.—For manufacturers of small electric light plants.

See our Collective Exhibit—Section "S," Electricity Building, Pan-American Exposition. Standard Welding Company, Cleveland, Ohio.

Inquiry No. 1226.—For manufacturers of metal blinds for store windows.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 1227.—For manufacturers or dealers in the fabrics used in making incandescent gas mantles.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1228.—For pumps and pumping machinery.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 1229.—For malleable iron gas, water and steam tubes and fittings.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 1230.—For brass valves and cocks.

Inquiry No. 1231.—For lead pipe and sheet lead.

Inquiry No. 1232.—For brass and copper brazed tubes.

Inquiry No. 1233.—For bottle washing and corking machinery, also all specialties in connection with the beer and whisky trade.

Inquiry No. 1234.—For patent labor-saving devices.

Inquiry No. 1235.—For novelties for steam users.

Inquiry No. 1236.—For woodworking machinery.

Inquiry No. 1237.—For girders and joists for builders and contractors.

Inquiry No. 1238.—For manufacturers of detachable handle flat irons.

Inquiry No. 1239.—For household and domestic novelties.

Inquiry No. 1240.—For manufacturers or dealers in small rubber pillow ventilators.

Inquiry No. 1241.—For manufacturers of machines for making tarred paper felts for roofing.

Inquiry No. 1242.—For builders of special machinery for weaving wire fences, etc.

Inquiry No. 1243.—For manufacturers of hot air engines with exhausts.

Inquiry No. 1244.—For manufacturers of cork grinding machinery.

Inquiry No. 1245.—For manufacturers of stone-crushing machinery.

Inquiry No. 1246.—For manufacturers of small tin boxes with screw lid suitable for mailing samples of sand three-quarters of an inch in depth and two inches in diameter.

Inquiry No. 1247.—For hand and power cure-cutting machines.

Inquiry No. 1248.—For manufacturers of iron try molds for making small aluminium castings; also mills to grind scrap aluminium.

Inquiry No. 1249.—For advertising novelties of the Buffalo Exposition.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(3324) P. J. F. asks: 1. Please inform me where I can get a small 6 or 8 16 candle power dynamo substantially built, to be run with a 1½ horse power gasolene engine. What style would best suit my purpose? A. All the electrical companies make both small and large machines. Any direct-current dynamo would do your work. 2. Is it practical to run a dynamo with a gasolene engine, viz., would the power be steady enough? A. If the gas engine is provided with a heavy balance wheel or a countershaft with a heavy pulley upon it, it should run steadily enough for the purpose. 3. Can I get a book to give me the information wanted? A. The company furnishing the machine will give all needed instructions regarding its installation, etc. Wheeler's "Dynamo-Tenders' Handbook," price $1 by mail, is a good book for your use.

(3325) R. A. P. writes: Unexpectedly I have been placed in charge of a small electro-plating plant consisting of two nickel tanks and two copper tanks, one of which is the instantaneous method of copper-plating by boiling solution. Here lies my difficulty, as I do not know the chemical composition of the tank, and being compelled to use it constantly, I fear the solution will weaken unless I replenish it. Could you tell me the composition of that tank and also refer me to a book on electro-plating? Not an extensive treatise on the subject, but simply the gist of it. A. There are many formulas for both nickel and copper plating solutions which differ so greatly that we cannot even make a guess as to the ones of which you have charge. It is certain, however, that any solution will not keep up to its strength indefinitely. When the plates of the metals are used up the solutions will run down. We can recommend Watts' "Electrical Deposition of Metals," price $1.00 by mail. You will have to take some lessons in the electrical features of your work. You can get these in night classes in your city in the fall and winter.

(3326) W. T. H. asks: 1. Can you inform me where I can get iron plates suitable for making first-class permanent magnets 1-16 inch or less thick? I have been unable to find anything so far better than saw blade metal. I have heard of an imported metal in bars which is claimed to be the best to be had, but cannot get it in sheets or plates. I want the plates soft, and will temper them after shaping them. A. A permanent magnet cannot be made of iron. Iron will not retain magnetism. You must have the best of tool steel, or tungsten steel if you can get it. It was probably this of which you heard. You can draw the temper, work the bars into plates and temper again. The high grades of steel are hard when purchased. 2. What are the chemical peculiarities of the iron most desirable for permanent magnets? A. There are no chemical peculiarities different from any steel. The proper percentage of carbon must be present in the steel. If tungsten steel is used this metal is also present.

(3327) B. A. T. asks: Please tell me how to double the power of the electric motor described in the issues of the SCIENTIFIC AMERICAN for December 8 and 15. A. To double the voltage of the motor wind twice as many turns on the field. This will give about twice as much power.

(3328) C. D. C. writes: I see in our street light system a porcelain fuse block, with fuses inserted in the line leading from the main line to the converter. This fuse block dangles at the side of the pole, and I contend that it should be protected in some manner. How would you think the best way to protect it? A. Fuse blocks are usually put where they can be kept dry.

(3329) E. P. asks: Will you be so kind as to furnish or assist me in securing a list of the decomposition of metals, acids, alkalies and salts by electricity? Would like it so stated that I can produce the decomposition in volts and amperes so in that way I will be able to reach what I am looking for. A. The subject of electro-chemistry is a very extensive one. We have not space to print what you ask. We can furnish you with Lupke's "Electro-Chemistry," price $2.50 by mail; or Whetham's "Solution and Electrolysis," price $1.90 by mail. These books will give you a start in the subject

(3330) C. C. A. writes: I note in SCIENTIFIC of this date, Query 8281, your explanation of the statement that zinc in a water pail would keep the pail from rusting, although you have never tried the experiment. I have had the experience, and have sought, but never found, a reasonable explanation of the fact before. Eleven years ago I bought a tin water-pail which had two strips of zinc about one inch wide soldered across the bottom of the pail in the form of a cross. The pail had a printed label attached stating that it would not rust. I used the pail constantly for a well water-pail about six years, without any evidence of rust. Upon examination at the end of that time I found the zinc considerably corroded, and taking it to a tinner had two new strips of zinc put in same position as the old ones. The pail is in use to-day, with no evidences of rust whatever. Of course an ordinary tin-pail would not have lasted one-fourth of the time without rust holes appearing. I have been told that an electrical current was set up which prevented rust, which, while true as a generalization, was not a sufficient explanation of how it prevented rust. Your explanation explains, but I should think a loose piece of zinc in the pail would accomplish the same result. Will you please state in "Notes and Queries" if that is so? A. The necessary condition for the action of the zinc and tin to prevent the oxygen from reaching the iron is a good contact of the two metals. This can be best produced by soldering the zinc to the pail. If loose, a larger piece would be required, and the contact would become uncertain as the metals became tarnished, which is only another name for corroded. When this took place the action might even cease altogether. These pails and other articles are now made with the zinc mixed with the tin, so it is claimed, and the same result is gained. The surface presents the same appearance as that of any ordinary sheet of tin.

(3331) G. W. H. writes: I read some time ago of a fluid which was invisible on paper to the eye, but which when viewed under a colored glass (blue, or green, I think, but forget which) it was easily seen. Can you give me any information on the subject? A. There are a number of substances which may be used for this effect. The most common, perhaps, is quinine. Dissolve this in water, to which a little acid, hydrochloric, sulphuric, or even citric, has been added. Paper is wet with this solution in any desired figure or pattern. View the paper through violet glass. A deep, dense shade of glass is required. Other substances which possess the same property are eosin, æsculin, fluorescine and uranine. The property is called fluorescence.

(3332) G. H. C. writes: A cold storage firm in Boston finds that the electric incandescent lamps which they burn in their cold storage vaults last about half as long as those burning in the offices, which are, of course, of ordinary temperature. Can you explain this? A. We have not heard any instance like this before, and have no explanation to suggest.

(3333) C. de V. asks: 1. I made a large plunge battery from the pattern as described in the "Experimental Science." I am having trouble with the cells leaking. I want to inquire whether the battery would have the same effect if the solution was in a trough instead of so many apartments? A. The battery will not give the same effects in a single cell as when each pair of plates has a cell by itself. Study a text-book upon the topic, "Mode of Connecting cells in Batteries." 2. The bichromate solution is so short-lived—only three or four hours—and then it runs down. Is there some other solution that will last longer and give good results? A. The bichromate solution is the best known for such a battery.

(3334) J. M. A. asks: 1. How can I tell the positive brush on a dynamo by Fleming's Rule? Explain Fleming's Rule. A. By placing the hand as the rule requires and applying the rule carefully to the coil under the hand. Fleming's rule does not seem to admit of explanation. It is a direct statement of what is to be done in order to determine the direction of the current in a wire. 2. Give some good rule to find the positive wire on a dynamo. A. The best way to tell the poles of a dynamo is to connect the voltmeter to the wire and when right the index shows the fact. If you have no voltmeter, you can use one of the chemical methods. Prepare a solution of starch in hot water and add a little iodide of potassium. Saturate some blotting paper with this solution and apply the ends of the wires of the circuit to the paper an inch or so apart, while the current is on. The paper around the positive pole turns dark from the liberated iodine which discolors the starch. 3. Have you any SUPPLEMENTS or books on switches and switchboards that tell all about them? A. No. Such work is learned from the Fire Underwriters' rules and the practice of the contractors who install apparatus. The dynamo tenders' hand-books contain much useful information. We can furnish you Badt's, or Crocker's, for $1.00 each. 4. Give short explanation about rotary and static converters. A. A rotary converter is a motor dynamo whose armature receives a current of one sort at one end and delivers the other sort at the other end. At one end of the shaft is a commutator, at the other end are collector rings. If an alternating current is sent in by the rings a direct current may be taken off at the commutator. The armature coils are connected as in direct current dynamos to the commutator bars. The coils of the armature are tapped off at symmetrical points to the collector rings, according to the form of alternating current. A static convertor is an ordinary transformer of which the induction coil is the best known type. They are commonly in use for reducing the voltage of alternating currents from the street pressure to that in house lighting. 5. Have you any SUPPLEMENTS that explain the automatic telephone? A. No. 6. What causes dynamos and motors to reverse themselves; and what is the remedy? A. There are numerous causes for the failure of a dynamo to generate. See the hand-books referred to above, under question 3, for both causes and remedies. We are not aware that a motor can reverse itself, since it takes the current given to it and goes ahead.

(3335) E. E. P. writes: We purchased the second story of a brick building and made a lodge room of it, taking out the partitions. We have a room with 32 x 62 x 15 feet ceiling. There are four windows in each end, and 4-foot ventilator in the center of ceiling. The floor is maple. But the echo or rebounding sound which arises is awful. We can hardly understand anything that is said—this sound is so great. Can you give us any information what to do with it? A. You do not say so, but we infer that the room has a flat ceiling, and parallel straight unbroken walls. Such a room would echo very strongly. The floor has little to do with the trouble, except when the room is empty. When the room is occupied the people cover the floor to such an extent that there is little space for the sound to be reflected from the floor. The remedy for the walls is to cover them with hangings so far as practicable. Colored Canton flannel will answer the purpose, if no more expensive hangings can be afforded. The idea is to cover the walls as fully as possible with some soft and yielding material, hanging loosely so that it will not reflect the sound, but absorb it. Now for the ceiling overhead. You may be able to arrange some festoons from the central ventilator to the corners, sides, and other points, so that the sound waves will be intercepted and destroyed by the drapery. Colored cheesecloth answers very well for this purpose, and is to be had in a greater variety of colors than bunting, which would be equally good.

(3336) T. L. S. writes: Referring to your issue of July 13, "Notes and Queries," No. 8267, would like to ask how about palladium and hydrogen? In a book on chemistry the statement is made that a thin sheet of this solid metal will allow hydrogen to pass through it as a sieve will water. A. It is true that hydrogen will pass by a process of dialysis through a thin plate of red-hot palladium. We did not consider that this sort of action was intended in the former inquiry. The metaphor of water and a sieve seems to be rather strong for the case. The request was for some gas that would pass through metals like light through glass.

(3337) O. H. asks: 1. I wish to charge electric auto, made of bicycle described in SUPPLEMENT 1195. What winding and what dimension shall I make dynamo for charging? A. You require 50 volts pressure in the charging current. The dynamo of SUPPLEMENT No. 600, price ten cents, will do the work for you. 2. Does positive brush be connected with positive plate of battery for charging? How long will it take to charge the same? A. Send the current in the opposite direction from that in which it flows from the battery. 3. If motors were made twice as wide with same number of turns and size of wire, would it give twice the power? A. It would about double the e.m.f. of the current from the dynamo.

(3338) J. H. W. asks: 1. Can you inform me why Weber, in his theory of induced currents relative to the phenomena of diamagnetism, had to assume that such currents flowed in paths of no resistance? A. We do not think the theory of dia-magnetism, held by Weber and advocated by Tyndall, is held at present by scientific men. Tyndall's book is now to be reckoned as among ancient literature upon this subject. Its chief interest is historical. 2. Have the various papers that have been read before scientific societies ever been collected into book form? A. The papers read before scientific societies are published in the journals of those societies, if such journals are published. Journals like the SCIENTIFIC AMERICAN gather up the most valuable of these papers and give either in whole or in abstract the best of scientific literature of the day.

(3339) W. W. P. asks: Will you please tell me some method of determining accurately if a room or house is damp, and, if so, how damp? A. Salt is a good substance to test the presence of dampness. Every housekeeper knows that the table salt sticks together in a lump in damp weather. It will also do the same in a damp room. Chloride of lime will turn liquid in a damp place. The rapidity of the change will enable one to judge of the degree of dampness. We do not know any scale of dampness by which to determine how damp a room is. A room in which soiled clothing or shoes will mold may be considered very damp.

(3340) J. J. C. asks: Would you kindly give me some information in regard to magnets and their resistance? I want to make some magnets as follows: One 5-ohm with a ⅜ core 1⅜ inches in diameter and 3 inches long. What size wire must I use, and how much? One 10-ohm, one 15-ohm, one 20-ohm, all the same diameter and length as the 5-ohm. A. Wind the 5-ohm spool with 380 feet of No. 21 single cotton-covered wire. The size of wire for the 10-ohm spool, to fill it exactly, falls half way between No. 22 and No. 23. You can wind 310 feet of No. 22 and 250 feet of No. 23, and have 5 ohms, of each, soldering the junction and covering it with tape. Or wind double the length of either, if you have only one size on a spool. For the 15-ohm spool the same is true. Wind 250 feet of No. 23 and 195 feet of No. 24, or wind double the quantity of either. For the 20-ohm spool, wind 195 feet of No. 24 and 165 feet of No. 25, or wind double the quantity of either. It is not usual to insist that the spool of a magnet must be filled with the wire. We should use the finer of the two sizes given in each case and fill the rest of the space on the spool with paper.

(3341) R. M. H. asks: 1. How can I convert the pure silver deposited on the bottom of the jar of the silver chloride cell described in the last edition of "Experimental Science" into sticks of chloride of silver so that I can use it in the cell again? A. The best way is to sell the reduced silver and buy new silver chloride sticks. It is not a simple matter to prepare the sticks. 2. Have you any supplements relating to the making of and using a portable testing set? A. SUPPLEMENT No. 1215 contains plans for a voltmeter and ammeter; price ten cents by mail.

(3342) L. C. asks: 1. I have a small direct-current motor with a bar-commutator. It runs on about 4 volts. If I substitute rings for bars on this commutator, can I run it with resistance on an alternating-current lighting circuit? A. Yes, but the resistance will need to be considerable. Take resistance enough to carry the amperes of the motor without heating and then adjust the resistance with the motor in series with the resistance till the motor runs at the proper speed. An equivalent choke coil or a small transformer would be more economical. 2. Will you please tell me if a 110-volt lamp would lose much brilliancy when run on a 104-volt circuit? A. Yes. 3. In the Nernst lamps in use in the Westinghouse Electric Company's exhibit at the Pan-American, iron wires in glass tubes are used as resistance after the light-giving portion of the lamp has been brought to incandescence. Why wouldn't these iron wires become heated and melt, as in the old, wire-filament incandescent lamps? A. Because the amount of current is not sufficient to melt the iron. The resistance of the lamp is high.

(3343) F. F. asks: 1. Is it the voltage or the amperage that burns out an incandescent lamp? A. Both the volts and the amperes are concerned in the action of an electric current. The volts furnish the pressure which overcomes the resistance and forces the current to pass. In a certain sense it is said that the volts furnish the shock when a person comes in contact with a live wire. But in this case the action is the same as above, the amperes flow through the body of the person and injure him by their action upon the tissues of the body. In the incandescent lamp too high a voltage forces too much current through the lamp and the filament is burned out, or, rather, dissipated, and lodges upon the glass, blackening it. 2. Do you know where I could get the necessary information to construct an alternating-current voltmeter and ammeter? A. We have not published the plans of such a meter. 3. When a rheostat is used on a dynamo does it lower the voltage or the amperage? A. The rheostat increases the total resistance of the circuit and therefore reduces the amperes flowing, if it is used in the line or external circuit. On the other hand, if it is a field rheostat, it changes the field resistance and thus allows more or less amperes to flow around the field. This changes the magnetism of the dynamo and thus changes the voltage of the machine. 4. I want to construct a dynamo for 15 lamps. Could you tell me how to enlarge the castings in SUPPLEMENT No. 600 so as to give the 15 lights? A. You would better get a dynamo already designed for 15 lights. About one kilowatt will do it. 5. In "How to Build Dynamo Electric Machines," by Ed. Trevert, he describes a 20-light Edison dynamo which has 20 pounds No. 23 wire on the field and 8 pounds No. 15 on the armature at 2,200 r.p.m. It gives 80 volts. How can I change it for 50 volts? A. Run the machine slower. It would be better to get a machine nearer what you need. It is not the best way to buy something and "fix it over." Go into the market and get what is adapted to your needs. 6. Have you a SUPPLEMENT describing an alternating fan motor? A. No.

(3344) R. V. asks: 1. How do you find the watt-output if you know the voltage and amperage of a battery? A. Multiply the volts by the amperes. 2. Could the primary and secondary of an induction coil be magnet wired? A. They should be. 3. Does it make any difference if common or magnet wire is used in the armature and field of a motor? A. Yes; use magnet wire. Magnet wire is common wire wound with cotton to insulate it.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

August 13, 1901,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Air brake, Hickey & Kellogg 680,456
Air brake drain cup, railway, P. Jacobson .. 680,330
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Animals, blind for the eyes of, E. Diedrich . 680,673
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Baling press, F. H. Dennis 680,410
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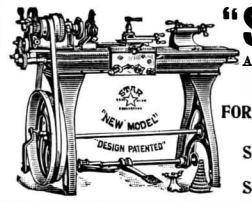

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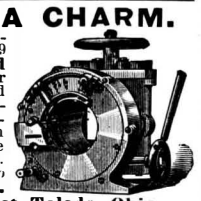

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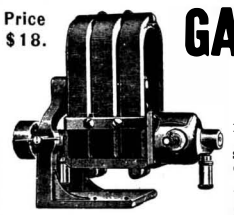

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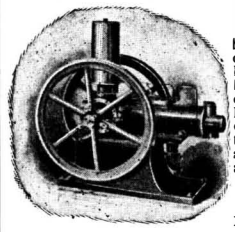

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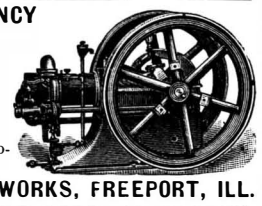

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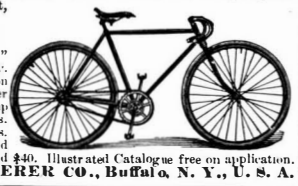
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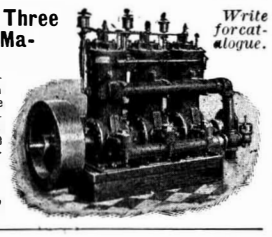
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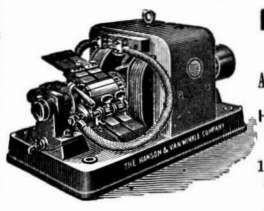
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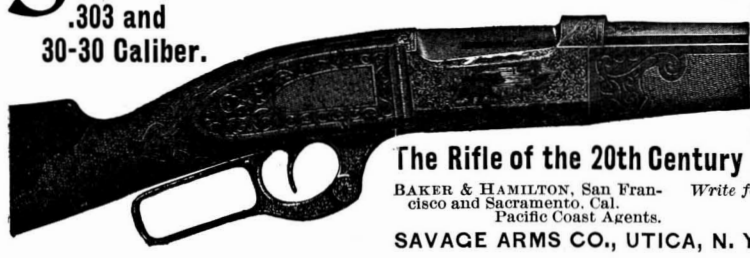
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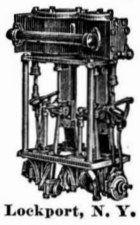
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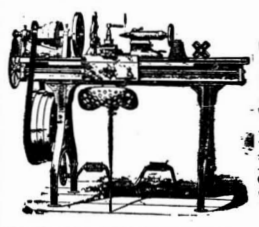
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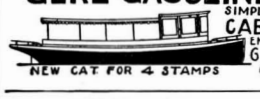
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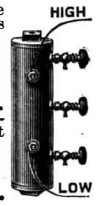

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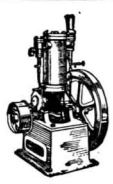

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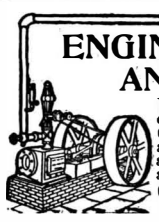

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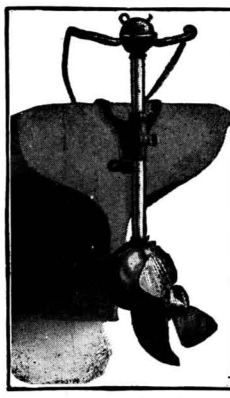

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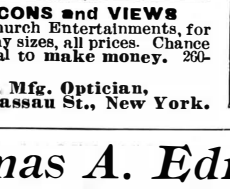

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